JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

The Chemical Manufacturers' Crusade against the Gas Industry.

THE Alkali Manufacturers' Association have won in their first attack upon the gas industry; and there is ground for the industry, now that the position is fully known, taking strong, vigorous, and if necessary concerted, action in this matter, to prevent the monstrous situation that has been created being expanded. Clauses putting a ring-fence round the manufacture of, and dealing in, residual products are to be imposed in the Amalgamation Bill of the South Suburban Gas Company, and in the measures of the Annfield Plain and Fleetwood Gas Companies. Their exact form was the matter of discussion towards the end of last week; and at the moment the wording of the clause has not been determined.

Plainly, the decisions are against the future economic development of the gas industry in relation to its residual products business; and honestly we do not believe either Lord Ritchie's Committee or Sir Harry Samuel's Committee fully understood all the circumstances surrounding this matter. Whether this be so or not, the Committees have played into the hands of a strong combine of chemical manufacturers, with a substantial influence in the House of Commons; and they have led off by putting crippling prohibitions on the gas industry, that are opposed to all sense and reason, and that are prejudicial to the public interests—doubly prejudicial through the limitation of the means of development in the important residuals department, and through the curtailment of competition by the protection of one particular trade run solely for private gain without statutory restriction. What the effect of such protection means needs no explanation to business men; and there can be no doubt whatever that the chemical manufacturers are laughing hugely in their sleeves at having so far secured from Parliament this protection of private trading interests. Does Parliament, however, realize the injustice that it is doing the gas industry? It is true that, in connection with the clause to be put into the Annfield Plain Gas Company's Bill, Sir Harry Samuel stated that the Committee did not wish this to be taken as a precedent for all future legislation, and that they could quite conceive special circumstances arising in certain cases—such as the necessity for a number of small companies combining for the purpose of doing the best possible with their residuals. But what is before us is a vastly larger question than that.

In our first editorial article last week, we referred to the freedom in manufacture and trading in residuals, and therefore in competition, of the owners of coke-oven and gas-producer plants; and there are the chemical manufacturers themselves. What the Parliamentary Committees are doing is the setting of precedents for the manacling of the gas industry in its competition with its two free commercial rivals. Take the chemical manufacturing firms forming the combination known as the Alkali Manufacturers' Association. Each one of these firms is situated in the district of some gas undertaking. Each firm may buy residuals from all the neighbouring gas undertakings who are not strong enough individually to profitably work-up their own residuals. The chemical manufacturing firm may do all this without let or hindrance, and then compete, backed by their larger and free resources, with the restricted resources of the gas undertaking which is their neighbour, if they can succeed in getting placed upon it the prohibition sought against buying residuals from other undertakings, or against buying the materials necessary to develop, in the largest possible measure, the business of recovering the valuable constituents of the secondary products. This is not just. Furthermore, the crusade is intended to limit the market of the small gas undertakings in disposing of their residuals, and to compel them to go to the chemical manufacturers. Again this is not just. These, however, are the monstrous propositions that the two Parliamentary Committees are, if not entirely (the event will show), largely supporting at the request of the protectionist chemical manufacturers, against the free competition of whom the gas undertakings have not asked for protection in their own districts.

However the question is examined, we cannot find any sound reason that has animated the Committees. Their decisions do not give any proper definition to the meaning of the enactments touching this matter which have been passed by Parliament—always in more or less similar form—during the last half-century or more; they are opposed to economic development; and they certainly do not give any expression to a desire to see a statutory concern given the liberty of action that, through the several safeguards imposed, serves so considerably the public interests. If we believed the Committees fully understood the position, then we should be at liberty to say that the only discoverable reason for their decisions was a desire on their part to endorse what is nothing more nor less than a form of trade plot to secure more freedom for private uncontrolled interests by limiting the freedom of parliamentary controlled interests. That is what it comes to. The promoters of the Bills that have already been attacked hardly realized at the outset the full significance of this movement on the part of the chemical manufacturers. They could not properly appreciate it until they had the representatives of this Trade Association in the box, and obtained from them, as well as from Counsel, admissions as to the extent of their programme in this matter.

Let us take Mr. Pearce, M.P., as an example. He stated without reserve in his cross-examination by Mr. Hutchinson that he wished to put a limitation on gas undertakings with regard to the manufacture of chemicals; and that the limitations he had in view were intended to apply to gas concerns that distilled tar. He further agreed that the effect of his limitations would be the indirect one that they would shut-out certain buyers from a gas undertaking, and it might make it impossible for the latter to sell to other gas undertakings. Let us quote examples of other pertinent remarks. Lord Zouche: "You want to prevent them getting raw "materials from outside?" Mr. Pearce: "Yes." Mr. Coward: "To prevent them getting raw materials from "outside for conversion into chemical products?" Lord Zouche: "And to that extent it would interfere with the "present practice." Mr. Coward: "We should interfere "no doubt with the present practice. There is no question "about that. The question is whether the present practice "is authorized by statute." Mr. Fitzgerald, K.C., also stated last Thursday that what the Association desired was to limit the promoters from purchasing from other gas companies chemical materials that were not residual products at all, and use these materials for the manufacture of other chemicals. We see from these statements, when pieced together, that the chemical manufacturers are not only trying to prevent gas undertakings purchasing residuals from other gas undertakings for manufacturing purposes, and so preventing other gas undertakings selling to gas undertakings, but they want to prevent one gas undertaking buying chemical products from another for the purpose of working up their residuals into other chemical products. The object is exactly focussed in the clause that the chemical manufacturers proposed at the outset should be put upon the gas undertakings: "Nothing in this Act, or any other Act con-"tained, shall be deemed to sanction the purchase by the "company of residual products arising from the manufac-"ture of gas, or materials of a similar composition, for the "purpose of converting such products or materials into "chemical products." There is no getting away, on these admissions, from appreciating the goal of the chemical manufacturers; and there is peril here for the future development of the residual products branch of the gas industry, unless the gas industry moves in the matter, and

induces Parliament to see it in the right light before the unfair and impolitic restriction is carried further.

The decisions ought to stimulate action. The South Metropolitan Gas Company have already taken steps to be heard, through Mr. Balfour Browne, K.C., as opportunity offers, against the restriction so far imposed on three companies. But the combined gas industry must speak with a strong voice against this crippling and domination by the chemical manufacturers of the gas industry's residual products business. In the interests of the future, the gas industry must not submit tamely to this. The miscarriage of justice has to be rectified.

Smoke Abatement Exhibition.

The Smoke Abatement Exhibition at the Royal Agricultural Hall was opened last Saturday; and we can fully recommend readers to visit it, and to induce as many of the public as possible to do the same. The exhibition has a mission to perform; and the success that attends such a demonstration as is made here means not only profit for the gas industry, but participation by it in improving the atmospheric conditions of our cities and towns, and making life healthier. As will be seen by the report appearing elsewhere, gas makes a robust display, through the co-operation of the London and other gas companies and the makers of gas appliances. The Gaslight and Coke Company especially are rendering yeoman service. Gas heating exhibits properly take predominant position; but lighting is not by any means neglected. Our electrical friends are also exhibiting; and there is opportunity for comparison here, but not such a close one as would have been preferred, owing to the withdrawal of the electricians into a little side hall, of which they are sole tenants. A report of last Saturday's opening proceedings, a description of the display made by the gas industry, and an allusion to the cookery demonstrations and competitions that are being held under the direction of Miss Helen Edden, are given in other columns. The lecture delivered last evening at the exhibition by Professor Vivian B. Lewes is also published, together with a reference to the "At Home" of the President of the Institution of Gas Engineers (Mr. R. G. Shadbolt) and Mrs. Shadbolt. We hope that, notwithstanding the difficulties of the moment, as many as possible of the administrators and technical and other officials of the gas industry will show, by personal attendance, their interest in the exhibition and the conferences, and thus reward those who are taking part in presenting to public view here the capacity of the gas industry for doing, as it has already done, a big part in the abatement of the smoke nuisance.

Dr. Davidson's Carbonizing Experiments.

Those who are looking forward to the special meeting of the Midland Association, when the paper that Dr. W. B. Davidson recently read (on the subject of carbonization in Dessau and horizontal retorts) will be discussed, will be interested in investigating the supplementary contribution that the author has contributed to our columns this week, and the further instalment that is to appear, we hope, in our next issue. We all know Dr. Davidson's care in, and enthusiasm for, any work of investigation that he takes up; and the tabulations and curves that are presented to readers to-day are eloquent of large industry on his part. We have much further information in the tables and curves, with the author's annotations, on the subjects of light and heavy charges in horizontal retorts, heavy charged horizontals and Dessau verticals, and other matters. It will be seen that the result of the inquiry shows that, within the limits of the investigation, while the yield of gas is greater with the verticals than with heavily charged horizontals, the figures are not so complimentary to the former as to the latter in the matters of illuminating and calorific values. The reason for this is found in the marked differences in some respects in the average composition of the gases from the two sources. But credit for certain individual advantages has to be accorded to both systems; and, as Dr. Davidson himself was pointing out a few weeks since, carbonizing systems cannot to-day be judged alone on their relative virtues in respect of gas production. We have submitted now the evidence of the fact that, within the scope of the investigation, steaming in the Dessau vertical retorts produces a water gas superior to that derived from any ordinary generator method, though poor coals do not lend themselves to steaming so well as rich ones. For instance, Dr. Davidson points out that, in one case, there is an addition of more than 15 per cent. of water gas, yet there is only 1·72 per cent. of carbon dioxide in the mixture, with the respectable amount of 3·49 per cent. of unsaturated hydrocarbons. In view of the formal discussion (which we know is being looked forward to with considerable interest, and which there is no doubt will be well attended if the trouble has been then lifted that at present rests upon the gas among other industries), we have only pointed here to certain of the features of this supplementary contribution, which will require careful study in order to follow, assemble, and appreciate the courses of events in the carbonization of similar coals under different conditions. The experimental results will also require testing by the aid of those obtained from daily working with the various systems.

Illuminating Engineering.

When the Illuminating Engineering Society commenced what has proved to be a very useful career, by investigating both scientific and practical subjects appertaining to illumination, we were doubtful as to whether it would not split upon the rock of controversial matters. The organization started with high aims, and an excellent resolve that all such questions should be studiously avoided. In fact, the eschewing of all controversial matters between the two great rival illuminants is the fundamental law, or, as the Chairman of the Council (Mr. F. W. Goodenough) expressed it last Tuesday, the "honourable tradition," of the Society. Up to last Tuesday, it had been discreetly observed; but on this occasion two speakers chose to break away from it, and both are identified with the electrical industry. The point was one of temperature; and as there were gentlemen present interested in printing establishments, the illumination of which was under consideration, the transgression of the rule was all the more in bad form. To the point, Mr. Goodenough had, if he had chosen to make use of it, an ample answer at command; but he took the more dignified course of not being a party to the breaking of the "honourable tradition," though, as Chairman, he did not (as our report shows) hesitate to utter a little remonstrance over the matter. The members generally ought to scrupulously support the Council in this matter of impartiality; and those who are connected with the electrical industry ought especially to render that support, seeing that the Society was born and reared in its early days largely in the electrical profession. We sincerely hope that this first incident of the kind will be the last.

The subject of discussion at the meeting was, as said, the illumination of printing-works—gas lighting being represented by Mr. Goodenough, and electric lighting by Mr. Justus Eck. The papers were illustrative of what is being done in this particular direction, and made no pretence of supplying rules for universal application. This cannot be done. In the several departments of a printing establishment, the work is so varied that the requirements in the matter of illumination are as severely distinct as though trades wholly detached were being carried on in them; and the circumstances of one works and another are just as varied. Yet, as the reader of the first paper says, his investigations have assured him that there is no other industry in which the successful running of a concern is affected so much by the character of the lighting as is this one. That is true, in view of the large amount of work—much of it of a delicate nature—that has to be performed after daylight fails. However, gas lighting need fear no rival in this matter. It is true that in many of the printing offices of the daily newspapers electricity is the light employed; but that is owing more to circumstances that told against the gas industry when the change was originally made, than to any comparison of the merits of the two illuminants in their most modern forms. This was acknowledged in the course of the discussion by the manager of one large printing establishment, which is lighted electrically. He said quite frankly that were he now starting afresh, in view of the modern advances of incandescent gas lighting, he should consider very seriously indeed the merits and relative economies of the two illuminants. It was demonstrated in the first paper that gas-lighting, more especially on the high-pressure system, is a very economical method for printing works. One has only to look at the tabulated figures of the author as to floor space, gas consumption, candle-feet, and other points to see how economical an agent it is. There is a

great deal of waste of light, and consequently of gas and electricity, in such places; and in view of the character of the operations carried on in many departments, which necessitate practically only light for individuals (the number of whom is a frequently varying one), point lighting by gas is found a successful and economical method. Even the old flat-flame burner comes in usefully among the machinery, where metallic filament lamps, connected by flexibles, cannot very well go, owing to the damage the lamps would suffer, and the danger from abrasion of the flexibles. In most of the operations, what is wanted is a good local light without glare; and, as Mr. Haydn Harrison (who is an electrical engineer) honestly says, for this purpose where a good local light is required, and the surfaces are dark, the inverted incandescent gas-burner requires a lot of beating.

The Forward Policy in Edinburgh.

SECOND thoughts are sometimes best. We are convinced that this is so in the matter of the means that the Edinburgh and Leith Gas Commissioners are adopting for the purpose of developing the day consumption; for further consideration by them has led to a broader policy than they were originally entertaining, by the removal of certain suggested restrictions in connection with the use of gas appliances, which, had they been adhered to, would only have had the effect of placing a drag on the very progress that it was desired to facilitate. This was a point that was made in an article, on "The Forward Policy," in the "JOURNAL" for Feb. 13 (p. 422); and we can now heartily congratulate the Commissioners on having divested their new policy of incommoding stipulations. This brings the policy more into accord with the broader views of the advisers of the Commissioners—Mr. W. R. Herring, Mr. A. Masterton, and Mr. A. Canning Williams.

We have a large amount of confidence that the Commissioners have done the right thing. Originally, the Sub-Committee who considered the question of the lines to adopt with the view of developing day consumption proposed that a rent of 2½ per cent. on the cost of cookers (fixed free) should be charged; but the cookers were only to be placed with the stipulation attached that the hirer was to guarantee a certain consumption. This guarantee was described by us in the article referred to as an obstacle; and it was suggested that it should be supplanted by a simple reservation that, if it was found that a cooker was not sufficiently used, the Commissioners should reserve the right to remove it. There is nothing so bad in the gas business as complicating matters between suppliers and consumers by introducing into their relations a lot of conditions. Consumers do not like them; and the idea of having to guarantee a minimum consumption would be just the thing to deter many householders from having cookers fixed, and yet those householders may be the very ones whose gas consumption would in ordinary circumstances have exceeded any reasonable minimum that might have been fixed upon as the line of the guarantee. In this matter of cookers, the Commissioners have decided to supply them free to all approved applicants, and to fix them without charge; and further—this is an important point—it has now been resolved not to require a guarantee of consumption; the Commissioners merely reserving the right to remove any cooker insufficiently used, or improperly used, or neglected. Instead, too, of limiting the availability of gas-fires to hire-purchase, the Commissioners have determined to also fix fires on simple hire. In this connection, they are going to co-operate with the local plumbers and gas-fitters for a year; and, if the experiment proves satisfactory during that time, the practice will be continued. This throws upon the plumbers and gas-fitters the onus of making the scheme a success in their own interests—reaping the reward of perseverance, or bearing the consequences of indifference.

There is one other interesting line in the new progressive policy at Edinburgh; and it is that the Commissioners are desirous of doing all possible to promote the additional use of gas among the prepayment consumers. The charge to them in excess of the ordinary has been 1s. 1½d. per 1000 cubic feet; but there has been a system of graduated rebates in force according to annual consumption. This system of rebates has not had a long run; but we can well conceive that it has been troublesome as between the department and the consumers. It is impossible to introduce a condition such as this carrying with it floating consequences in business relations with the poorer section of the community without creating a certain amount of worry, friction, and discontent. What the Commissioners have therefore resolved upon has been to reduce the extra price charged to these consumers to 7d. per 1000 cubic feet; and the graduated rebates will cease. Under the rebate system, the average excess price has worked out to about 11½d. per 1000 cubic feet; so that the prepayment consumers will, taking the average, benefit considerably by the change. They will know exactly what they are paying, and how much they are buying; and there will be no subsequent question as to the sum to which they are entitled by way of rebate.

The broader view the Commissioners have taken in the matter of a forward policy is satisfactory; and, from the experience elsewhere, we have great confidence in their action being fully vindicated by results.

Important Decision as to a Servant's Authority.

In our "Legal Intelligence" will be found the decision of Mr. Justice Bray, at the Manchester Assizes, in an action brought against the Manchester Corporation by a tramwayman to recover damages for injury to his son—a child four years old—through the alleged negligence of one of their servants, named Ford, a gas inspector. He had found a prepayment meter out of order, and had attempted to remedy the defect by the use of his penknife. Failing in this, he went for tools; leaving the knife in the room where the meter was. In his absence, the child picked up the knife, and cut his eye so badly that it had to be removed. The learned Judge left to the Jury six questions, one of which was: "Was the act of Ford in attending to the meter done in the course of his employment, and purporting to act on behalf of the Corporation, or was it a voluntary act, as the result of the request of a neighbour?" The Jury replied in the affirmative; and they awarded £125 damages. Having heard the arguments on behalf of the plaintiff, his Lordship, without calling upon the Counsel for the Corporation, gave his decision in their favour. He said Ford had not been sent by the Corporation to do any work at the plaintiff's house; and he was not even furnished with tools—his duties being merely to inspect. It seemed to him, therefore, that there was no evidence on which the Jury could find that Ford was acting in the course of his authority.

High-Pressure Gas for Industrial Use.

It is very difficult for a man to be frequently writing papers about one subject without retraversing some of the same ground; but although Mr. E. W. Smith, M.Sc., has at short intervals been delivering to the gas profession, and to the technical students of the industry, messages regarding his work in the investigation and application of high-pressure gas to manufacturing purposes, he always manages to find something fresh to say in regard to the subject. This is so in the paper that he read before the Midland Junior Association last Saturday. The paper touched more or less lightly on many of the constituent matters of the general topic. But it is patent at the very outset of the contribution that, the further Mr. Smith goes into this subject, the more pronounced becomes his view that there is a vast field in industry for the applications of gas at high pressures. We should have, however, lost some little part of the hope with which we are possessed if Mr. Smith had not prefaced with the words "in many respects" the statement that "it is inevitable that it will take years of experience and experimenting before a complete understanding of the way to deal with gas under high pressure is reached." We believe that, in Birmingham at all events, a very fair understanding has been arrived at as to the best way of applying gas under high pressure to certain industrial purposes. Hence the popularity there of which Mr. Smith speaks towards the end of the paper. One of the several interesting points in this contribution is the question of the height of pressure. Practice varies in this respect; but practice must always be guided by requirement. In Mr. Smith's opinion, for distribution purposes 5 lbs. to the square inch is all that is necessary; but, after much experimenting, it has been found that, for certain classes of work that are general in Birmingham, the best results can be obtained, with the burner employed, when the gas is at a pressure of 12 lbs. Why this is so, can be gathered from the account given by Mr. Smith of experiments made as to the volume of air that can be injected through the high-pressure burner that is commonly used in the city for metal-melting purposes.

PERSONAL.

Mr. H. A. Coombs, of the Cheltenham Gas-Works, has been appointed Junior Technical Assistant to the Gas and Electrical Engineer (Mr. W. J. Rendell Baker) of the Malvern Urban District Council.

At a recent meeting of the Directors of the Scarborough Gas Company, Mr. Philip Allan was appointed Assistant-Manager and Secretary. Mr. Allan has been engaged during the past four-and-a-half years with the North Middlesex Gas Company, at the Gas-Works, Mill Hill.

Mr. G. Hancox, Assistant at the Malvern Gas-Works, on his leaving to take up duties as Assistant-Manager of the Ormskirk Gas Company, was on Friday, the 15th inst., presented with a travelling rug by the staff and employees at the gas-works; the presentation being made by the Engineer and Manager of the works (Mr. W. J. Rendell Baker).

At a recent meeting of the Birmingham Corporation Gas Committee, Mr. William Alfred Twine was appointed to the position of Superintendent of Chemical Plant, in connection with the gas-works of the city. For nearly nineteen years Mr. Twine has been in the employ of Messrs. Brotherton and Co., Limited (who are among the largest ammonia and gas residuals firms in the world); and for some considerable time past he has held the position of Chief Chemist and Assistant Works Manager at their Birmingham works.

It will be seen, from a paragraph in the translation of the report of the German Continental Gas Company which appears elsewhere, that on the 1st of May Dr. W. von Oechelhaeuser will retire from the position of General Manager of the Company, which he has occupied since Jan. 1, 1890, and in which he succeeded his father. He has been in the Company's service for thirty-one years; and during this period the amount invested in shares has increased by 87·5 per cent., the fixed capital by 160 per cent., and the general reserve and extension funds by 800 per cent., while the annual output of gas has risen from 1130 to about 3100 million cubic feet. Dr. von Oechelhaeuser is known personally to many of our readers, and universally by name in connection with his gas-engine; and we are sure all his friends will join us in wishing him health to enjoy the rest which relief from the responsible duties he is relinquishing will bring.

ELECTRICITY SUPPLY MEMORANDA.

Seeking for Known Causes—And Fresh Remedies—Shadows and Domestic Electrification—Co-Partnership—Low-Priced Units—The Mains and the Cookers—A Gas-Page Advertisement and an Electrical Circular—Concealing Light Values—Small Concerns—Faversham's Burden—The Diesel Engine.

Last Thursday the members of the Institution of Electrical Engineers had their first informal discussion on the question of how best to increase the use of electricity for domestic purposes other than lighting. The members of the Institution have lately been discussing that interminable subject electricity tariffs until they could not find anything fresh to say, and much that was said was suggestion that has been exhumed time and again, and that has not in the past (any more than it is likely to do in the future) accomplished much to enliven the uses of electricity for purposes other than lighting. The discussions on tariffs were the prelude to the informal conferences that are, it is understood, to become part of the staple business of the Institution. Informal discussions appear to be a badly felt want among the members, if we properly appreciate the views to which expression has been given by the President of the Institution (Mr. S. Z. de Ferranti), by the Technical Press of the industry, and by some of the manufacturers of electric appliances. It is stated that it is a matter of great importance to know why it is that electricity is not used more largely for domestic purposes. Do the central-station managers mean to say that the electricity supply business has been running now for about thirty years, and they cannot answer the question without informal discussions? If they avow their inability, then the position is one which is not a little astonishing to an observer of the course of events both inside and outside the electricity industry. That individually the engineers and managers of the sister industry are unable to specify the retarding causes is professed by the statement that the object of the proposed discussion is to find out, and to bring about a clear understanding of, all the causes and reasons that militate against the general adoption of electricity. It is clear from the plural terms employed that there is no capital or single cause; so that there is something rather formidable to cope with; and this must be accepted as supplying the electrical justification for the informal but serious discussions.

Having discovered the causes, there are the remedies to be determined; and it is said that, when the remedies are revealed, it will be necessary to take concerted action, both in the interests of electricity, and to the great benefit of the public. Some of our electrical friends believe that they know better what is for the benefit of the pockets of the public than the public know themselves. In this they have pirated the view of a great Chancellor of the Exchequer. But it is seen from the facts and from the admissions of our electrical friends that the public are not prepared to accept all electricians choose to tell them. The electrical industry has been taking concerted action for some time through the Electricity Publicity Committee, and through big and expensive exhibitions; and still there is complaining that the public are not taking kindly to the "other uses." Of course, there is a lot of bunkum about the electricians' assertion that it is necessary to take counsel together to ascertain the causes. The electricians themselves have published a list of "some" suggested causes, to the number of thirteen or so items. If these are only "some" of the causes, then the electricity industry as the universal provider of all heat required for domestic purposes stands a very poor chance of reaching the goal that its own good opinion of itself has marked out. The list shows that the principal causes are well enough known. The first is stated to be "price of energy"—the word "cost" would have been better; and associated with it should have been the words, "and low thermal value of the energy supplied for the money." The next item is "cost of electricity-using apparatus (radiators, cookers, iron-heaters, &c., &c.)." The plain fact requires no comment. The "failure of electricity-using apparatus" (failures in the general supply were inadvertently omitted) is the next ascribed cause. Truth will out. "Cost of repair and maintenance of apparatus" together with "general inconvenience of the appliances," might have been inserted here, but again was accidentally overlooked by the electrical compiler. "Want of knowledge of what electricity can do economically and well" is charged with being a "cause." This is a sad reflection on the Electricity Publicity Committee, exhibitions, advertising literature of central stations, and so forth. But some electricians with consciences do not like to talk of these matters from the economical point of view. Buried in the middle of the causes—probably so as not to come upon electrical readers with a swiftness that might do them intellectual and moral damage—are these: "The great facilities given by the suppliers of gas in the way of hiring apparatus at very low terms to induce consumption; and cheap coal, cheap gas, cheap oil." As to these causes, we have nothing to say, beyond that they are really among the most prominent, and that the gas industry will not allow their electrical competitors to prescribe remedies for them. The other "suggested" causes may be lumped together: "Natural (!) objection to change; installation of houses; cost of service from street where more power required; the unsatisfactory tenure of electrical undertaking, which renders the raising of capital for giving a cheap supply so difficult; also want of really good business methods in pushing sales; want of educational work; want of advertising." This is a solid bundle of obstacles. When we remember how the public have been educated on the subject of "poisonous" products of gas combustion, and the foolish quack style of many electrical advertisements that have been prepared for arresting the public, we think the two last-named causes might have been safely omitted from the list. However, the gas industry have received with the utmost composure the announcement that their electrical friends have commenced to systematically and sympathetically take counsel together.

It is not stated how many years these informal discussions are to continue with the object of discovering known causes. But if many years are to be spent in the unprofitable quest, then the final result will be of little use to the electricity supply concerns of the Metropolis, as in 1931 the London County Council will have the right to enter into possession. "Meteor" writing in the "Electrical Times" in a little fit of gloom, fancies he can already see the shadow of 1931 falling upon some of the Metropolitan concerns. The County Council will not now let the Borough Councils forget the fact that their years are numbered so far as electricity supply is concerned; and they are keeping it well in mind by maintaining an oversight (as becomes such an interested party) over the loans and capital of the undertakings. But generally in other respects the electricity companies and borough councils are keeping themselves well in line with the times, so far as their opportunities allow; and therefore we cannot help thinking that the shadow "Meteor" fancies he has seen must have been due to some little passing disorder. But journalistically he is not altogether alone. Sir William Crookes, as Chairman of the Notting Hill Electric Light Company, has been telling the shareholders that he and his fellow-Directors are considering the question of being—following in the footsteps of the gas industry—the pioneers of co-partnership in the electricity industry. "Electrical Industries" (also with 1931 in mind) is disposed to throw cold water on the humane scheme. This contemporary says:

> A steadily progressive industry, which varies little in character as the years go on, is a favourable field, but one with fluctuating profits is the reverse, as it means that the workmen mny be called upon to share out zero or a minus quantity. Electricity supply may be jog-trot enough to invite the experiment of co-partnership; but its future, in the case of London Companies, is not very clear. Ultimate purchase is certain; purchase within a few years is probable, as a result of the investigations which have been set on foot by the London County Council in regard to the whole question of electricity supply in London. That being so, the suggestion of co-partnership seems to be rather like establishing hopes which will be disappointed in a few years' time.

Perhaps one of the things that "Meteor" took for a shadow is the scheme, "in view of prospective developments," of the Directors of the Brompton and Kensington Electricity Supply Company to carry on by means of a subsidiary Company such portion of the Company's business as may not come within the scope of

their Provisional Order. So far as we understand the position, the new Company will take over the show-room and fittings business of the Electricity Supply Company. "Meteor" seems inclined to think that another contributor to the shadow is the generally ruling high price for domestic electricity supply in London. We are rather afraid that the blame for this is not so much due to 1931, as to the extremely low power and heating rates obtaining in some districts in London, which have year by year been consistently bringing down the average revenue per unit, without reducing average over-all costs at an equal rate. As the volume of power business increases, this downward movement (from which the private lighting consumers do not benefit) must continue. There are signs of a little change of view on this point of low power prices. At West Ham the average of the power prices has been slightly raised; and this can only have been done by a higher charge for some of the new power business. Again, at the recent meeting of the Charing Cross Company, the Chairman admitted that the average price for power was somewhat low, and said the Directors were trying to raise the price, and were now only offering energy to large consumers.

It is plain now that the low-priced electricity business for power has made such marked strides, and that the business demands heavy capital expenditure on its own account, the managements of some undertakings are beginning to ask whether they can continue to pursue the reckless course of doing business, as in some cases, at a figure barely above the average fuel cost per unit. "Meteor" recognizes this point when dealing with the question of the development of a cooking load. He says this is not such plain sailing as it appears; and he adds: "Suppose that there were a big popular movement in favour of electric cooking—what of the mains." We can see the electrical engineer dwelling long over that "suppose" and the beautiful thought accompanying it as to a "popular movement." Then the shock, "What of the mains?" Yes, "what of the mains?" when a load came on to the generating-station between (say) 11 and 1 o'clock on Sunday mornings such as gas undertakings experience. "What of the mains" with that short-hour load at 1d. per unit? What of the gruesome sacrifice of the old tariff principles that were said to be scientifically sound, and ought not to be violated? "It is difficult," says the philosophic and reflecting "Meteor," "to see how cooking and heating can be dealt with in any great quantity at our present copper prices and distributing pressures." No one but bagmen of electric-cooker manufacturers will venture to disagree with him. It is noticed that the "Tricity" people boast that there are now 4000 cookers "in use." We are not sure whether "cookers" include boiling appliances or only ovens; but any way the 4000 spread over the country is not a large figure, and cannot have caused worry to any central station engineer by their having caused alternating light and heavy loads. When one considers the number of "Tricity" cookers standing on view in electricity show-rooms, and the number purchased for experimental purposes, it may be imagined that it is hardly right to say there are 4000 "in use." It is common knowledge, to anyone acquainted with the showrooms of electricity concerns, that they are not all "in use."

In the "Streatham News," we recently came across one of the best page gas advertisements that has yet been seen. There was not too much matter in it—merely a two-column chatty article, written by a representative of the "News," printed in clear readable type, and illustrated by nine reproductions of photographs of the picturesquely furnished, or practically fitted, rooms of a model home, in which all the lighting and heating for whatever purpose are done by gas. The house is at Telford Park, Streatham Hill; and it is the Show-House for the district of the South Metropolitan Gas Company, which Company have a large system of publicity in active operation. It will be remembered that some time since there appeared in the "JOURNAL" an illustrated description of the Company's Catford Show-House (see "JOURNAL," Vol. CVII., pp. 366, 374); and this Streatham one is on much the same lines, but, if anything, still more attractive. We have the cheerful hall that in itself bids a hearty welcome; there are the drawing and dining room, the bedrooms, the bath-room, the kitchen, and the scullery—all completely fitted with modern gas burners and heating arrangements; while the hot-water supply, and ironing are all performed by gas. There is demonstrated here a perfection in convenience. As this page advertisement was being read, a circular arrived from a local Electricity Supply Company; and there was a point about it that was rather striking when brought into contrast with the gas advertisement. The burners used in the Gas Company's Show-House are of the "Metro" type (now becoming very popular in their area). The statement is made in the advertisement (and it is demonstrably true): "As regards the economy of gas lighting, a medium sized 'Metro' burner will give, at the very least, 50-candle power for the consumption of 2½ cubic feet of gas. One pennyworth of gas—nearly 40 cubic feet—will keep a 50-candle power burner alight for sixteen hours." The electricity circular on the face puts the question, "Can you get any clean and good light as cheap as electric light?" At the foot of the page are the words: "Some convincing figures." We turn to the figures; and find they are not convincing, through an important omission. There is not a word about the quantity of light that is given for the prices mentioned. It is a most disingenuously devised statement; and the County of London Electric Supply Company, Limited, know something as to the authorship. It states: "Drawing room, to artistically light, with two lamps, one penny for five hours. Dining-room: An elegant light, brilliantly concentrated on the table, one penny for five-and-a-half hours. Bedroom: For ordinary use, under one penny per week. Bathroom, &c.: For the whole quarter, under one shilling. Kitchen or hall: A good light, one penny for nine hours." Supposing the cost of current is 5d. per unit, and take the drawing-room only as an illustration of the light offered, a pennyworth of electricity used in five hours would only allow for two 16-candle power lamps! The Company prescribe for a doll's house—not a house with decent sized rooms in it. Why do not the Company adopt the same open method of advertising as their gas competitors? Perhaps the 50 candles for sixteen hours for 1d., with modern inverted gas-burners, is the explanation.

There are not many small independent electricity undertakings, in the minor country towns that can be run profitably. There is no question about it that such concerns could be, and can be, conducted more economically, where there is a demand for current in small towns, in conjunction with a gas-works. Site, management, and cheap fuel—everything is in favour of moderate-cost running. The Board of Trade it is hoped will take this into consideration in determining as to who shall have the right of electricity supply in Bognor—the Gas Company or a private applicant for a Provisional Order. The local authority at Faversham possess an undertaking that serves as an illustration of the difficulty of making the small undertakings pay. Nearly £23,000 has been expended on the concern; and the revenue from the sale of current to private consumers only amounts to £1122, and that from public lighting to £712—together £1834. Sundry receipts bring up the revenue to £1919. The total working expenditure comes to £1689; so that there is a balance of about £230 for transfer to net revenue account. The local rates are therefore called upon, in respect of the past year's working, for just about £1240 to make up the sum required to meet interest and repayment of principal. That is to say, the ratepayers have, whether they like it or not, to contribute much more to the support of the concern than the revenue derived from private consumers. Since the undertaking began, the ratepayers have had to pay £7425 towards the maintenance of this censurable piece of speculation. This £7425 is almost equal to one-third of the capital expenditure! Besides this we are certain that the Gas Company could, with modern gas-lamps, give the ratepayers a higher illumination for the £712 than the Electricity Department is doing. Altogether the ratepayers last year paid nearly £2000 towards the support of this white elephant. Why the ratepayers should pay more than the private electricity consumers are doing is one of those mysteries that have grown around the principles (if so they can be truly called) applied to municipal trading in electricity. To say the least, it is a shameful condition of affairs.

At the recent meeting of the South Metropolitan Electric Supply Company, the Managing-Director (Mr. H. W. Bowden) read a table to the shareholders showing the total average works costs per unit of thirteen companies in London. It is interesting; it would have been more interesting if it had shown the average cost of the capital and other charges in a third column, and the average receipt per unit in a fourth column.

Company.	Output in Million Units.	Works Cost per Unit.
No. 1 London Electric, with a railway load	21·0 ..	0·82d.
,, 2 South Metropolitan Company . .	4·8 ..	1·01
,, 3	4·1 ..	1·03
,, 4	25·2 ..	1·08
,, 5	25·7 ..	1·12
,, 6	16·9 ..	1·18
,, 7	9·9 ..	1·39
,, 8	18·9 ..	1·52
,, 9	12·2 ..	1·53
,, 10	6·0 ..	1·76
,, 11	4·1 ..	1·79
,, 12	2·2 ..	2·08
,, 13	2·6 ..	2·19

Bearing upon this subject, it is noticed that, in more than one instance, it is acknowledged that there seems but little chance of making further impression upon works costs, especially in view of the facts that the price of coal is more likely to increase than decrease, and that the character of the business for which a bid is now being made, is of a fluctuating and short-hour kind. Several undertakings are adopting the Diesel oil-engine for the purposes of reducing costs and to give them two strings to their bow. The matter of adopting these engines was raised at the meeting of the South Metropolitan Electric Company by a shareholder; and another one—Mr. H. Boot—stated that, as the engineer of a station entirely dependent on Diesel oil-engines, he could say they are not altogether the wonderful blessings they are said to be by the Press. Like other engines, they have their drawbacks—if not in fuel, in the shape of repairs. Fuel costs, too, depend on the market; and the oil market in these days is showing a remarkable tendency to make up and down movements in price in company with solid fuels.

The Gas-Engine in Principle and Practice.—We have received from the publishers, Messrs. E. & F. N. Spon, Limited, a work bearing the above title, by Mr. A. H. Goldingham. The text includes a comparison of the two-cycle and four-cycle types of internal combustion engines, with notes on suction and pressure gas-producers, crude oil vaporizers, &c. The book, the price of which is 6s. 6d. net, will be more fully noticed in a subsequent issue.

NOTES FROM WESTMINSTER.

THE narrative of Committee work last week in both Houses, so far as gas interests are concerned, is not a long one; but importance is not to be judged by length.

Chemical Manufacturers and Residuals.

The matter ot greatest moment to the gas industry is the success of the Alkali Manufacturers' Association in the cases of the South Suburban, the Annfield Plain, and the Fleetwood Bills in inducing Lord Ritchie's Committee and Sir Harry Samuel's Committee to restrict the working-up and dealing in residual products to the bare individual production of those gas undertakings. The Association have not got so much as they wanted; and what they are fighting for would mean, as would the present restriction if generally applied, a serious disability for the gas industry in connection with residuals products. Even yet, until the Committees have determined with the Parliamentary authorities the form of clause to accept to cover their decision in these three cases, we cannot tell exactly what it will be made to cover. The Gas Companies have suggested one form of clause; the Association another—the latter, it seems to us, passing well over the limitation suggested in the Committees' decisions. Before the Committees started discussing the form of clause, Mr. Balfour Browne, K.C., in both instances, tried to obtain a hearing, for the South Metropolitan Gas Company, against any alteration of the Bills. But the Committees refused to hear him, on the ground that he could only appear on such a petition during the progress of a Bill; and as the evidence had been completed, it was ruled that learned Counsel could not in these instances be heard. Sir Harry Samuel's Committee were inclined to a little more latitude than the Lords Committee. They expressed a strong opinion that there might be cases in which small companies should be permitted to join together for the purpose of rendering more effective their residual products, and in other cases also there might be special circumstances. This being so, they did not wish their decision to be binding on all future legislation. The Annfield Plain and the Fleetwood Companies, in our opinion, are excellent examples of companies that might some time do better with their residuals by working in conjunction with others. But what have the Committee done? They have deliberately prevented this by the restriction to be placed on the Companies, who could only try to get relief from it by again applying to Parliament at a cost which would be rendered heavy by having to meet the relentless hostility of a wealthy combination of chemical manufacturers. The matter is discussed in our editorial columns; and therefore the general aspects of the matter can be left here. But the general feeling among the gas engineers who have been at Westminster this week (including the President of the Institution, Mr. R. G. Shadbolt) is that the industry ought not to leave the question where it is; and that the most strenuous effort should be made to prevent any further trammelling of gas undertakings, for the advantage of private interests, in a manner that absolutely creates a *cul de sac* in regard to any future developments of the residuals branch of the business of the industry—a business that is exposed to unfettered competition by other producers and chemical manufacturers who are not of the gas industry.

Fleetwood Gas.

There was a fair amount of interest in the proceedings on the Fleetwood Gas Company's Bill; for the Company came up with a clean slate, and the Council were asking for a purchase clause—this being the first time the Company have been to Parliament for full statutory powers, their operations having hitherto been conducted under a Provisional Order. The readiness of Sir Harry Samuel in seeing that the Council had not been able to compile any bad record against the Company, and in detecting the weak points in the Council's position, put a little life into what would otherwise have been somewhat dreary proceedings, owing to the Council's case being so obviously one constructed, without any sound material, for this occasion only. The Company asked for the consolidation of their capital on a 5 per cent. basis, for the consequent alteration of the sliding-scale, for £30,000 of additional capital, with one-third borrowing powers, and the preservation of £1700 existing unexhausted borrowing powers. The standard price of gas it was proposed to reduce from 4s. 5d. to 4s. 2d. The "Metropolitan" No. 2 burner and 14-candle gas were also among the modernizing changes proposed to be effected. Naturally, following the time-honoured order of things, the Committee were seriously told the Company were asking for too much capital; but the reasons advanced for this by the Council's representatives were most noticeable for their vagueness. The proportion of loan capital was also considered insufficient. There was no trouble about this, however; the Committee simply determining that the one-third proportion should apply to the old as well as to the new capital. The Council also objected to electricity being included in the stand-by clause. The Council own the local electricity supply undertaking. Mr. E. H. Stevenson was the expert witness for the Council. Thoughts reverted to Swansea. The Company were not particular about retaining the word "electricity;" so it was deleted. As remarked, the Council run the electricity works, which they acquired at a cheap rate. Notwithstanding their ownership, they have long considered that they should also have the gas-works under their charge. But in negotiations, their ideas of value were evidently ordered, so the Chairman of the Committee seemed to think, by their purchasing experiences in the case of the electricity concern. They now asked for a purchase clause. It happened that the Committee had been told that the Council—being the owners of the electricity supply—had refused to allow the Gas Company to tender for certain street lamps; so that away went competition for a public service. Here, again, the Chairman considered this was a good argument against the gas and electricity undertakings being both under the control of the Council. The Company had one technical offence registered against them. In the recent years of prosperity, they have been building-up their reserve by greater appropriations than the regulation ones, believing that they were entitled to do this to make up for past years when the reserve could not conveniently be supplemented. There is to be an adjustment of this small lapse from the path of rigid technical integrity; and this will be dealt with when the residual products clause is under consideration to-day. The Company have no objection to this; so that the net gain by the Council as the result ot their expedition to Westminster is slender, and not worth the expense. Mr. H. E. Jones, Mr. R. G. Shadbolt (President of the Institution of Gas Engineers), and Mr. S. Shadbolt, Manager of the Company, supplied the technical evidence in support of the Bill; while Mr. E. H. Stevenson performed the same duty for the Council.

AN AMERICAN CENTENARY CELEBRATION.

A CORRESPONDENT who from time to time favours "JOURNAL" readers with information upon gas affairs in the United States, writes as follows with regard to a forthcoming celebration in Philadelphia of the hundredth anniversary of the granting of the Gaslight and Coke Company's Charter.

Your readers may be interested in knowing that Philadelphia, linked to London in so many ways in the past, will in April be the scene of a centenary celebration in which London is peculiarly concerned. Four well-known Technical Societies of national scope have joined together to observe the hundredth anniversary of the granting of the Gaslight and Coke Company's Charter. They are the American Philosophical Society founded by Franklin, the Franklin Institute (closely identified with the introduction of gas into Philadelphia), the American Chemical Society (interested in the gas business as one of the industries in which the chemist has played a large part), and the American Gas Institute (the national spokesman for the gas profession). While the celebration is primarily one of an anniversary belonging to the industry, and not to this country, it happens that it was in 1812 that David Melville built, at Newport (R.I.), the first gas-manufacturing plant erected here. Therefore, perhaps, we may consider that, to a small extent, we are celebrating an anniversary of our own.

The following is the programme of the celebration.

Thursday, April 18.

8 p.m.—"Bye-Products in Gas Manufacture," by Charles E. Munroe, Ph.D., of Washington (D.C.), Professor of Chemistry at the George Washington University.

Friday, April 19.

10 a.m.—"The Commercial and Financial Aspects of the Gas Industry," by the Hon. George B. Cortelyou, of New York, President of the Consolidated Gas Company.

11 a.m.—"The Technic of Gas Manufacture," by Alfred E. Forstall, M.E., of New York, Secretary to the Trustees Gas Educational Fund of the American Gas Institute, and Past-Secretary of the American Gas Association.

2 p.m.—"Gas as an Illuminant," by Van Rensselaer Lansingh, President of the Illuminating Engineering Society.

3 p.m.—"The Use of Gas for Heat and Power: The Testing of Gas," by Edward B. Rosa, Ph.D., Chief Physicist at the National Bureau of Standards.

"These lectures will constitute an interesting and valuable review of the development of the use of gas as an illuminant, and as a source of heat and power. Persons interested in the manufacture and use of gas from all parts of the country, members of the Societies named, and the general public (including ladies), are cordially invited to attend the sessions.

"An effort will be made to bring together as many as possible of the pioneers in the gas industry—those who have been engaged in the industry thirty years or more.

"A temporary loan exhibition will be held in the hall of the Franklin Institute, of articles, models, appliances, books, or pictures that have an historical interest."

The paragraphs above quoted are from the announcement as issued to the members of the participating Societies. The programme gives a good idea of the standing of each lecturer, and his qualifications for the proper presentation of his subject. Dr. Munroe is the Census Bureau's expert special agent for the chemical industries, this including gas manufacture. Mr. Cortelyou, formerly a Cabinet officer, is the head of our largest Gas Company. Mr. Forstall had many years of experience as a gas manager. Mr. Lansingh speaks as a fitting representative of his Society. Dr. Rosa brings the knowledge of a Government bureau that has been working hand in hand with our gas engineers.

Blood *is* thicker than water after all; and a celebration such as this helps to strengthen the ties that bind us to the land that most of us still think of as the Mother Country. A greeting from London to Philadelphia next month would add still further to the sentimental interest attached to the affair.

THE SMOKE ABATEMENT EXHIBITION

At the Royal Agricultural Hall, March 23 to April 4.

A GOOD DISPLAY OF GAS-HEATED APPLIANCES AND SMOKELESS FUELS.

Success! At one time, it was feared that the Smoke Abatement Exhibition which was being organized to be held at the Royal Agricultural Hall, during the fortnight just entered upon, would lack the support of a fair number of exhibitors. But fears on this score were recently banished by energetic action; and despite the coal strike, the inconveniences of railway transport, and the high-pressure time that makers of gas-heating appliances are now having, there has been brought together in the Agricultural Hall an exhibition that we hope as many as possible who are interested in the question of the abatement of smoke by the use of gaseous fuel or coke will make an effort to visit, and induce others to do the same. The London and Suburban gas companies have distributed thousands of free tickets; so that the gospel of gaseous heating and cooking, and the intelligence of the influence it has already had, and will continue to have, on the prevention of atmospheric pollution, should be carried far afield. The Gaslight and Coke Company have made a special effort to induce members of the medical and architectural professions to visit the hall during the course of the exhibition; and special endeavours have also been made to secure a good attendance at the lectures and conferences on smoke abatement to be held on Tuesday, Wednesday, and Thursday this week. Professor Vivian B. Lewes led off last evening with a lecture on "The Relation of the Gas Industry to Smoke Abatement"—this event succeeding the "At Home" by the President of the Institution of Gas Engineers (Mr. R. G. Shadbolt) and Mrs. Shadbolt. The text of Professor Lewes's lecture appears in this issue (pp. 867-69). Everything points to success in the direction of public attendance at the exhibition; and the success of the display itself merits it. We especially congratulate the Coal Smoke Abatement Society under whose auspices the exhibition is being held, its Secretary, Mr. Lawrence W. Chubb, and the Organizing Manager, Mr. F. W. Bridges.

The Opening Ceremony and the Luncheon.

An exhibition of this kind must have its opening function. It is the best means of drawing public attention to its objects and aims; and a very distinguished company it was who were present at the inauguration of the display last Saturday, shortly after noon, by His Grace the Duke of Argyll, who was accompanied by the President of the Coal Smoke Abatement Society (Sir William B. Richmond, K.C.B., R.A.), the President of the British Association (Sir William Ramsay, K.C.B., LL.D. D.Sc., F.R.S.), the Treasurer of the Smoke Abatement Society (Dr. H. A. Des Vœux), and numerous others. Looking round the company assembled in the pavilion, or met immediately afterwards, we observed Mr. D. Milne Watson, the General Manager of the Gaslight and Coke Company, Professor Lewes, Dr. Samuel Rideal, the Hon. Secretary of the Institution of Gas Engineers (Mr. S. Y. Shoubridge), Mr. A. E. Broadberry, Mr. F. W. Goodenough, Mr. H. O. Carr, Mr. C. W. Offord, Mr. Charles Hussey (Chairman of the Croydon Gas Company), the Secretary of the Institution (Mr. Walter T. Dunn), and there may have been many others who, unfortunately for the completeness of the report, were not seen. Many well-known electricians and engineers engaged in other branches of work in which heating has part were present, as well as well-known men who have taken a distinguished share in the smoke abolition campaign.

The actual opening ceremony was commendably brief. An appropriate little speech was made by the Duke in declaring the exhibition open; and, in an equally commendable manner, Sir William Richmond thanked His Grace for his presence and good wishes. Then a perambulation of the exhibition was made, after which luncheon was served, with Sir William Richmond in the chair. There were about 170 guests.

Gas the Easiest Thing in the World to Manage.

After luncheon, the usual loyal toast was honoured, and then

Sir William Ramsay proposed "Success to the Exhibition." He remarked that there were a great many appliances in the exhibition which dealt with the removal of smoke or its minimizing; and there was a choice which would suit any particular taste. During the last few years, he had been working with gases, in large and small quantity—small from the technical and experimental point of view. He had managed to deal with small quantities of gas that could be contained in a tube no larger than a needle. He had managed to measure and weigh them; and this had brought him to the conclusion that the easiest thing in the world to manage was gas. Although they could not see it, they knew where they had it. It would change from place to place just as one chose. By pressure at one end of a pipe, one could make it stream at whatever rate and pressure one liked. At the other end of the pipe, one could do what one liked with it. Coal gas was very easily conveyed, and very easy to work with. It had occurred to him that their mission as a Smoke Abatement Society would be very much simplified if no coal were burned. [Laughter.] An ideal state of things would be to have the coal-retort in the bowels of the earth. Put a shaft down till the coal strata were reached. Having sunk this boring, put down a tube with a concentric tube inside. Air could be passed down by means of an air compressor to carbonize the coal. When the coke was at a white heat steam could be passed through it, and water gas made. This was an excellent fuel; and why should it not be made underground? Following upon this, it was obvious that the right thing to do would be to use gas-engines at the mouth of the shaft. The gas-engine was most economical. Whereas few steam-engines used 15 per cent. of the energy of the coal, most gas-engines utilized 30 per cent. Thus the yield of energy was doubled. By this means, electricity could be made at the pit mouth. Having generated the electricity, at very little cost, it could be transformed and conveyed at high-tension currents where one liked. This would solve the strike problem. [Laughter.] And he would suggest that the miners should very carefully consider what they were doing at the present moment, lest their business should be gone from them, which it would be. The resources of science were not by any means at an end. Electricity, distributed where one wanted it, could be used for heating; but it was expensive, and it had not been elaborated enough yet. But electricity at 100th part of a penny per unit could be used for anything one liked. [Laughter.] He had dreamed a dream, and seen a vision. He proposed "Success to the Exhibition."

Sir William Richmond, in reply, said when politicians failed, men of science must come in, because a man of science approached questions without any party feeling. Sir William Ramsay was on the progressive side of the human race. Thirteen or fourteen years ago, when it fell to his lot to start a crusade against the smoke nuisance in London, if he had been told that this luncheon would be held in the centre of London, and that he, a humble painter, and, as he used to be called, an unpractical æsthete, would be surrounded at it by scientific men, engineers, and practical workers all combined as they were from different points of view to settle this great question, he should not have credited it. The exhibition was profoundly interesting. It used to be said the manufacturers did all the mischief. This had been contradicted. Domestic fires evidently contributed an enormous deal of smoke to the nuisance. There were shown here appliances that were going to minimize smoke in domestic chimneys. What they had to do was to enlist public opinion on the subject, to excite it, and remove if possible, a certain apathy which he was afraid belonged strongly to the English character—apathy which said: "This did very well for my fathers, it ought to do equally well for me." This was not progress. The exhibition showed them that smoke should be a thing of the past. Sir William Ramsay had just alluded to the possibilities of doing away with coal. The present coal strike might be productive of further scientific investigation. The great scientific intellects of the country in his opinion would not be slow in combining to defeat what looked as if it possibly might become a very great tyranny. This exhibition ought to enlighten the British public. The appliances shown were numerous, ingenious, and, from his point of view, not in the slightest degree unlovely. He thought they owed sincere thanks to Mr. Bridges, but for whose indefatigable energy the exhibition might have been a failure. For his own Society, he must not forget their energetic and interested Secretary, Mr. Chubb, whose all-round intelligence, good nature, and strong character must have done a great deal to make the exhibition a success.

Dr. Des Vœux proposed "The Visitors." He hoped the exhibition would be a success from the exhibitors' point of view, because their success would be helping forward the propaganda that they had been working upon now for years. Smoke in the air of London had been very much diminished from what it was two or three years ago. He believed the continuous days of dense fog they used to experience had gone to return no more, though there were more people now in London than formerly.

With the toast the names were united of Mr. Gough, L.C.C., Dr. Shaw, Director of the Meteorological Council, and Professor Bostock Hill, President of the Society of Medical Officers of Health.

General Notes.

This function at an end, there was more time to spend among the exhibits. The first thing that strikes one is that there is plenty of room in the large hall for visitors to circulate about, and to examine the exhibits. There is no overcrowding. Practically every stand is independent of its neighbour; and the exhibitors have adopted the excellent plan of only having samples on their stands, so that the visitor can inspect thoroughly each article, instead of being confused and prevented from doing this by the stands having the appearance of miniature stock-rooms where space is valuable. In the main hall, the gas industry has no doubt the pick of the positions; the rest of the occupied space being utilized for displays of exhibitors with smoke prevention appliances for industrial use, or by firms showing the advantages of smokeless solid fuels, or appliances that promote smokeless combustion. In the main hall, there is hardly a firm employing electricity to be seen. The electricians have shown an exclusiveness that does not give one an idea of a common participation in the campaign for obliterating the smoke evil, by constituting themselves into a sort of side-show in a small hall in the entrance corridor to the main hall, where the exhibits are so packed that a very few people in the place constitute a crowd, preventing free circulation, and any proper inspection of the exhibits.

However, there is more space for locomotion in the large hall, where on Saturday the Gaslight and Coke Company's Prize Band (Kilburn Branch) were performing under the Hon. Conductor, Mr. A. E. Horstead. It is a fine band, and we congratulate the members upon their high accomplishments. Next Saturday there will be another opportunity of hearing them; and on other days military and other bands will be performing.

General Lighting.

At night time the large hall is excellently illuminated. The general means of illumination consists in one part of 25 Keith

lamps of 1200-candle power each; and in the other part some "Excello" flame arc lamps have been fixed specially for the exhibition. On a stand on the left-hand side of the hall as the visitors enter will be found the compressing plant that the James Keith and Blackman Company have installed, and which supplies the high-pressure lamps. There are two sets of plant, consisting of size "C" compressors, coupled-up to "National" gas-engines. Outside the Gaslight and Coke Company's cookery demonstration hall, there are seven of Sugg's "Regent" lamps of about 300-candle power each; and these make a good show, and attract attention to the hall at night time. Most of the stands are illuminated by inverted gas-lamps.

Gas Cookery Demonstrations.

Mentioning the gas cookery demonstration hall, we cannot do better than at once give a little information regarding it, and of the work that will take place in it, and which will form an important feature of the exhibition during the current fortnight. The main part of this demonstration hall is 40 ft. by 60 ft. The walls are relieved by white decorations; and baskets of flowers are suspended from the ceiling. Seating accommodation is provided for about 200 visitors. The lighting of the hall is by seven three-light Wenham low-pressure inverted lamps. On the side of the hall facing the entrance, is an ample platform, upon which cookery demonstrations and competitions are taking place. The dominating spirit of these demonstrations and competitions is Miss Helen Edden, who presides over the instructional and demonstration cookery work of the Gaslight and Coke Company. Assisting her is Miss Parkyn (whose new gas-iron is noticed elsewhere in this issue), and five other demonstrators. On Saturday, Miss Edden used for her demonstrations the cooking-stove that she herself has designed, and which incorporates all the conveniences that her skill in the culinary art has suggested. The exhibiting makers of gas-cookers will all have their productions in this line brought into similar prominence during the run of the exhibition. Samples of their cookers are arranged along the back of the platform; and these are being used for the competitions. The demonstrations will be at three and four o'clock in the afternoon; and practically all the evening there will be competitions and other attractions in the hall.

Adjoining the demonstration hall, there is a pretty tea-room, arranged with small tables, with floral decoration. The lighting here is also by Wenham low-pressure lamps, which have a very pleasing appearance. Free teas will be dispensed here to the Gaslight and Coke Company's consumers. The Company are to be congratulated upon their enterprise.

The Joint Gas Exhibit.

In dealing with the gas exhibits, first place must be given to the stand organized by the Gaslight and Coke, the South Metropolitan, the Commercial, the Brentford, and several other suburban and provincial companies, with the assistance (alphabetically recorded) of the Davies Gas-Stove Company, Limited, Messrs. Fletcher, Russell, and Co., Limited, the Richmond Gas Stove and Meter Company, Limited, Messrs. Wilsons and Mathiesons, Messrs. John Wright and Eagle Range, Limited. This stand occupies a prominent stretch of space in the main part of the exhibition; the superficial area occupied being 2256 square feet. The exhibit is divided into three sections: (A) 41 ft. by 16 ft., (B) 50 ft. by 16 ft., and (C) 25 ft. by 16 ft. The apartments are divided by 8 ft. 6 in. high division walls in the "A" and "C" sections; and in "B" section there are five squares set diamond shape, each square being filled with fires supplied by one or other of the makers already mentioned. By this means a fine display is made; and the fires catch the eye of the visitor before he or she reaches the stand. About 50 feet length of the space is occupied by this "B" section. The division walls are painted cream colour. The middle stand is carpeted with grey felt, and the end ones, where the kitchen, bath room, and industrial exhibits are disposed, are covered with linoleum. The lights on "A" stand are fitted with Pneumatic lighters; and on "C" stand by the "Telephos" distance lighters. It is altogether a striking display; and we congratulate Mr. F. W. Goodenough upon the result.

There is so much to notice that we cannot give space to the individual exhibits. Taking "C" section first, attention is claimed by Maughan's (Parkinson Stove Company) water-heaters of various types, all in operation. There is a shower bath shown, and a lavatory basin, fitted with a "Pearl" geyser. In the adjacent apartment are seen Ewart's "Calefont" heaters in operation, with two baths—one of them a baby's bath, which will attract attention from the lady visitors. There is a pedestal lavatory basin fitted with a "Brilliant" geyser, by which gentlemen visitors will be pleased to learn that shaving water can be obtained in about 20 seconds, which is a consideration in the morning. The heating of the section is by steamless radiators.

In the industrial department are shown the use of gaseous heating from delicate appliances such as are employed in dental surgery, up to a massive tilting-furnace. There is an assortment of annealing furnaces, muffles, jet furnaces, blow-pipes, &c., for both high and low pressure work. There are also greenhouse and motor garage heaters. The names of Fletcher, Richmond, and Wright are found on the various exhibits. This is the first time we have seen Wright's tilting gas-heated furnace; and its convenience is striking. It is for large work. The crucible part is made to tilt by hand. The metal having been melted, the vessel is just tilted up, and the molten material poured direct into the mould. The advantage of this needs no explanation. Further economy has been studied by utilizing the waste products for the heating of a small crucible in a casing that forms the cover of the top of the large crucible when in vertical position.

Turning to "B" section, on which gas-fires are shown. As said, there are four fitted to each diamond section. Some are in grates, some are shown standing before coal-grates, some in tiled recesses—all handsome, all inviting favour, all challenging the right to claim some superiority, all making it difficult to select any one. The purse must, in some cases, be the arbiter; for there is a difference in the values, according to style. However, they are demonstrating effectively how clean, smokeless, labour-saving, gaseous heating in the home can be accomplished. The fires exhibited are by the makers already mentioned.

While inspecting the goods on this stand, visitors should give attention to a fire burner invented by one of the employees of the Gaslight and Coke Company. There is the mixing-chamber, but instead of the gas-nozzles being on top as ordinarily, the jets are fitted in front of the chamber, protruding so ⌐. The columnar fuel saddles on the shank, so that the nozzle and flame are central in the vertical fuel—just as the flame is in the upright mantle of an incandescent burner. Supposing a coal-grate with a curved front is required to be fitted for gaseous heating, the gas-chamber can remain perfectly straight; and the curve secured by having the jets with different length shanks. This is a very useful burner for making a good and effective job of the fitting of an ordinary coal-grate for gaseous heating, using the modern form of fuel. Gas and air regulation is provided. We believe that Messrs. Fletcher, Russell, and Co. have this burner in hand.

This section of the combined display is, for local illumination, fitted with "Nico" inverted burners and "Candle" burners, with oxidized silver fittings. The furniture was supplied by Messrs. William Whiteley.

Turning to the kitchens, we have here the artizan, middle-class, and hotel kitchens all illustrated. Suitable cookers, grillers, grill on stand, pastry ovens, boiling-rings, gas-irons, water-heaters, circulating-boilers, a coffee roaster, coppers, and most of the useful gas-heating accessories for the kitchen are there, demonstrating labour-saving, smoke and dirt annihilation, and all supplied by the various makers.

In a recess in the middle-class kitchen by the side of the cooker is a hot closet, heated by hot-water coils, for warming plates or keeping food warm. In the Gaslight Company's experience, this has been found highly successful. It is a convenience secured absolutely without running cost, as the heat is obtained from the ordinary flow-and-return of the hot-water circulators.

In the model hotel kitchen are seen Fletcher's cooker, Parkinson's cooker, Davis's triple-oven cooker, Wilsons and Mathiesons' "Advance" cooker, and a large grill, hot closet, carving table, water coppers, stock-pots, and general kitchen utensils—the last-named being supplied by Messrs. William Whiteley. There is an object-lesson here for hotel-keepers, club managers, and restaurateurs generally, as well as for the managers of large public institutions.

In a small office on the stand, a gas-fitted medical bracket is observed.

The following are the individual contributions of the makers to the combined exhibit at the exhibition:

Messrs. Davis and Co., Ltd.: No. 2027 16-inch gas-fire, armour bright; No. 3 "Apollo" fire, armour bright; No. 2 "Vesta" fire, black; No. 3 "Minerva" fire, green; No. 2062 gilled circulator; No. D408 39-inch steamless radiator; No. 310a treble oven cooker; No. 606 vegetable steamer; No. 9120b hot-closet and carving-table.

Messrs. Richmond and Co., Ltd.: No. 2539 gas-fire, black; "Adam" fire, armour bright; "Renaissance" fire, art copper; "Flambeau" fire, armour bright; "Daisy" heater; No. NO150 twin oven furnace; No. NM. 10 twin muffle furnace; No. 6200 blast-hardening bench forge; No. NC35 crucible furnace; "Blackpool" boiler.

Messrs. Davey and Roberts: Coke boiler and hot-water-plate warmer.

Messrs. Ewart and Son: Geysers, &c.

Uno Company: Coffee roaster.

Messrs. Fletcher, Russell, and Co.: "Tokio" fire, black; "Borneo" fire, brown enamel square; "Jersey" fire, black and white tiles; No. 2962 square register, without tiles, with new "Jet" burner fire; No. 24 "St. James" oven; Floral radiator, enamel; griller; grilling-table; gas-iron; and industrial appliances.

Messrs. John Wright and Co.: "Kenilworth" dog grate, 17-inch armour bright; "Merlin" gas-fire, 14-inch bronze; "Talisman" fire, 14-inch pearl grey; "Stadium" fire, 17-inch black; "St. Andrew" radiator; "Garajo" heater; "Sun" boiler; "Calefactor" circulator; "Eureka" gas-cooker; "Bordo" cooker.

Messrs. Parkinson and Co., Ltd.: Geysers, &c.; "Spartan" fire.

Messrs. Wilsons and Mathiesons, Ltd.; No. 3 "Savoy" fire, black with B/B; No. 2 "Carlton" fire, grey; dog grate; "Warwick" fire, black; "Advance" cooker; circulator; "OO Brighton" radiator; "W/M" boiler.

Other Cooking and Heating Exhibits.

Leaving the combined exhibit, we look round the independent stand of Messrs. R. & A. Main. A lay visitor was standing before one of the firm's fires with the long columnar fuels slightly inclined; and he was heard to remark, after testing the heating power by means of his hands held a little distance away, that the appearance and heating value of the fire struck him as being

excellent. This visitor was seen hanging round that fire some time after. The lines of gas-fire that are being principally shown on this stand are the "D. S. O" and "St. Nicholas," of the details of which our readers have been informed. As to their heating values and æsthetic qualities, there are the fires asking for the judgment of all who visit the show. Also seen are gas-heated steam and other radiators, cookers, grillers, and numerous other articles that make the household what it should be when it reaches the ideal state—a non-contributor to the pollution of the atmosphere.

The same may be said of the stand of the Cannon Iron Foundries, Limited. We can congratulate the Company on the highly ornate appearance of their stand, and the general excellence of its arrangement for the examination of the goods displayed. A good setting attracts greater attention to a gas-fire than when standing, as it were, unframed. One can see better what a gas-fire will look like when fitted in position. Here we have an artistic centre-piece, forming two tiled fire-places, back to back, fitted with "Iris" and "Oto" fires, and both beautifully enamelled in the manner for which this firm have obtained a large reputation. The fires are thoroughly up-to-date in all the details. Those named are only two of several. Steamless and gas-steam radiators are seen. There are types of the firm's cookers on view; and we stop to take a glance at the handy "Shamrock," which is suitable for households without much space to spare. It is very neat, very handy, and, standing on legs, very convenient. Several other attractive exhibits are on view, in which gas is the heating agent; but they cannot all be catalogued.

We are attracted by the neighbouring stand of the Thermal Syndicate, Limited. Here is shown a variety of pure fused silica (quartz). The information is given that this material is perfectly acid and heat proof, and is quite unaffected by extreme and sudden changes in temperature. It is stated that high-pressure gas-lighting firms and makers of gas-fires are looking into the virtues of the material for application in their wares.

The Carron Company are also among the exhibitors.

Mr. Thomas Potterton at his stand is showing the new "Sealed-Oven" cooker, of which a special description appears on another page [870] of this issue.

Messrs. Tilley Bros. are exhibiting their well-known "Hot-Ray" gas-fire. The burners are non-lighting back; and the gas-supply is controlled by a patent governor. There are two of these fires shown in ordinary grates, and a basket fire fixed in a recess. At an adjoining stand (where the firm's high-pressure gas system is shown) are seen rollers and irons for laundry work, jewellers' crucibles or muffles, &c.

The N.V. Hoels Gashaardenfabrik are entered for an exhibit in the shape of a gas hearth which will, it is said, give the maximum amount of warmth with the minimum consumption of gas.

Water Heating.

In addition to the exhibits on the gas companies' joint stand, to which several makers have contributed, on various separate stands water heating by gas appliances is shown. It is clear there is a big field for active work in this direction, as the high efficiency of the appliances on view must commend itself to the public.

Among other exhibitors, we have Mr. Thomas Potterton, showing, fitted and at work, various types of "Victor" boilers and accessories. There are seen here the "Victor" automatic gas-heated hot-water supply apparatus, working examples of gas-fired heating apparatus for small greenhouses, conservatories, motor garages, &c., and warming apparatus for all types of buildings heated by boilers using smokeless fuel. Facing the visitor to the stand is an example of the "Victor" automatic gas-heated hot-water apparatus, which makes a compact equipment, and one that is easily installed. We have here embodied the cut-out system, whereby the most economical working is ensured. The complete plant consists of a boiler or boilers, cylindrical or rectangular hot-water tank, thermostat, safety-valve, emptying cock, pipe connections, cut-out valve, concrete blocks and tray. Therefore all that is required in fixing is to lay on a cold water supply to the tank, carry an expansion-pipe with branches for draw-offs, provide the flue-pipe connecting the boiler to the chimney, and couple up the gas-supply. The work is then complete.

Messrs. R. & A. Main, Limited, at their stand are showing gas-heated geysers, wash-boilers, and other methods of obtaining hot water rapidly.

A bold display is being made by Messrs. Ewart and Son, Limited. Their gas-geysers are shown in great variety, by the use of which hot water can be obtained without waiting. We have the well-known "Califonts" here—the largest size giving some 16 gallons per minute, down to one supplying 2 gallons in the same time. For lavatories, samples are exhibited supplying 1 gallon per minute. Several are shown working—one the 46 B "Califont," which delivers 10 gallons per minute, and supplies four services. Here, too, is the "Ever-Ready" boiler for restaurant purposes. Water is maintained by it just below boiling-point; and on turning on the water, the gas is also turned on and boiling water commences to flow instantly. For hot water provision in all parts of a house, the firm show by demonstration how it can be readily accomplished.

Mr. J. Shannon is exhibiting, and demonstrating to visitors, the rapid heating virtues of the Hammond water-heater. It has features quite distinct from other water-heaters. An open highly aërated flame plays freely on the bottom of the heating portion of the apparatus. The claims for it are the rapidity of heating, and the large range in the quantity of water it can supply at short notice. A bye-pass is fitted to all the heaters; and there is no possibility of explosion. Its use is only confined by the limits of the requirement for hot water in households and business premises. Auxiliary to the ordinary form is an automatic regulator (which is supplied at a small additional price). This attachment only allows the gas to be on when the water is running, and shuts off the gas at once should the water fail through any cause. A high-pressure valve for supplying the bath-room can also be fitted to the appliance.

At the stand of Messrs. James Stott and Co. is shown a patent gas-kettle or water-boiler for the supply of boiling water; and it is stated to be the only kettle from which water cannot be drawn until it boils.

Smokeless Fuels.

Coalexld Limited are here proving to demonstration the virtues of their smokeless fuel, which is obtained in ordinary gas-works retorts by the application of chemicals. The claims regarding the improvement effected in the quality of the gas and bye-products, and especially the coke, have been brought before our readers on various occasions, and therefore need no reiteration now. There are two fires burning on the stand, beautifully incandescent, without smoke or any smell. A good heat is radiated by the comparatively small fires; and the attendant volunteered the information that the heat given off is 40 per cent. greater than would be obtained by burning the same quantity of coal or ordinary coke in the grates. There was comparatively little ash after the fires had been running all day on Saturday.

A competitor in the same line is the product of the Premier Tarless Fuels, Limited. Like Coalexld, it is smokeless. It is produced by the carbonization of coal in vertical iron retorts at low temperatures—low as we regard them in gas-works operations. Some of the gas produced is utilized for heating the retorts; the remainder is "disposed of." The price of the fuel works out to about the same figure as coal—when the coal market is in normal condition. Fires fed by the fuel testify to the various claims made for it.

The British Coalite Company, Limited, entered for a display of their particular product; but it failed to arrest attention on Saturday (unless accidentally overlooked), so that presumably the Company had not then matured their plans for exhibiting.

Lighting Exhibits.

In addition to the Keith high-pressure lighting in the large hall, and the Sugg and Wenham types of low-pressure lamps outside and inside the cookery demonstration rooms already described, as we have said most of the stands are illuminated by inverted incandescent burners.

Among special exhibits Messrs. Podmore and Co. have a stand displaying, in lighting, various forms of their well-known high-power lamps for interior and exterior use. The lamps on view (which are fitted with from one to four burners) bear out the reputation of the firm for high lighting efficiency at low pressure, and good and artistic workmanship. All the parts of this firm's lamps are renewable; so that, at a comparatively low cost, they can prolong the lives of their lamps that have already seen good service. This is a matter of importance, in these days of lamp hiring by tradesmen.

Messrs. J. Marse and Co., Limited, are showing a series of the popular "Visso-Marse" incandescent gas-burners, with consumptions ranging from ½ to 8 cubic feet per hour, and light of 16 to 250 candle power. These burners have a high efficiency, as testified by the ½ cubic foot for a 16-candle light. Such small units as 16-candle power have a tremendous field for use; and the burners being specially made for the small consumption, the efficiency mentioned is maintained. Such an efficiency cannot be proportionately obtained when a small light is required with any burner made for a larger light. The Company are showing two types of the "Astrona" upright burner, and a new type of "Visso-Marse" inverted burner. A further exhibit is an incinerating-machine of the Company's design for burning-off silk mantles.

Almost facing the visitor on entering the main hall is the striking stand of Messrs. D. Anderson and Co., who are showing their latest improved forms of the "Dacolight" lamps. At night time, a central post carrying some of these lamps draws the visitor to the stand by the brilliance of the illumination. The lamps of the firm are suitable for both high and low pressure gas; and the range of the illuminating power of their productions is from 40 to 3000 candles. Opportunity is afforded here for examining Smith's patent storm-proof street-lamp—a form used by the Liverpool Corporation. Other types of lamps, and the firm's ingenious gas-controllers for lighting and extinguishing, invite inspection.

At one of the stands of Messrs. Tilley Bros., there is seen a display of the firm's system of high-pressure lighting. The compressor used is a very small and compact one. Any motive power can be employed for driving it. In this case, a small electric motor is fitted. The stand has a 1500-candle power light outside; and inside a 300-candle power one, and two of 200-candle power. At the adjoining stand, where the Company's fires are being exhibited, 100-candle power lights are in use, supplied with gas from the high-pressure plant.

On the stand of Messrs. Bilbie, Hobson, and Co. we have dual interest. Not only is lighting shown here on Thorp and Marsh's system (or, as it is designated, the "B.S.T." light), but there are on view two gas-engines of the Hornsby-Stockport type. One is equal to 2¼-brake horse power and the other to 11-horse power, both on town gas. These are fitted with magneto-electric ignition, and a special arrangement of valves. Regarding the lighting, the

stand is illuminated by 130-candle power high-pressure burners; and the compression is effected by Marsh and Thorp's combined blower and governor, with bye-pass arrangements suitable for the passage of gas to the extent of 100 cubic feet per hour. The compressor can be worked off any line of shafting, or by any form of motive power independently provided. The light is very steady and brilliant. The lamps are made in sizes equal to 130 up to 1000 candle power. Experience in factories and elsewhere has proved the economy of the system. Among the miscellaneous exhibits are several examples of Marsh and Thorp's burner testers, and their combined anti-pulsator and governor to prevent pulsation of gas in mains, and are suitable for gas-engines of 10-horse power.

Smoke Prevention from Retort-Houses.

The smoke abolitionists can have explained to them at the stand of the Woodall-Duckham Vertical Retort and Oven Construction Company, Limited, the differences between the old style retort-houses and those on one of the most modern of systems of carbonization for gas production in the matter of the prevention of the pollution of the surrounding atmosphere. The central exhibit on this stand is a brickwork section of retort on the Woodall-Duckham system; this illustrating the arrangement of the flues and the construction of the retort. But the most imposing exhibit is the bottom ironwork (full size) of a retort—comprising the device used for regulating the discharge of the coke, a receiving-hopper, constructed to hold three hours' discharge of coke, at the bottom of which is fixed a water-sealed gas-tight door. A model illustrates in detail the entire construction of the settings and the integral parts. The Kerpelly producer is also shown here in model. This is a method of making producer gas from poor quality fuel. The system is continuous in working, the clinker being extracted automatically; and by its use fuels containing a very high percentage of ash can be gasified, giving gas of good and even quality. There is much interest here for the gas engineer.

Scientific Instruments.

In gas-works and other industrial establishments, a large amount of apparatus is now available that will give very complete chemical control.

At the stand of Messrs. Townson and Mercer, we are able to examine Somerville's sulphur and sulphuretted hydrogen apparatus, the "Metrogas" nitrogen apparatus, Hornby's gas analysis apparatus, Dickenson-Gair's gas analysis apparatus, Orsat's apparatus for the same purpose, and much else too extensive to individually mention.

Messrs. Simmett and Co. are also showing several scientific instruments for laboratory and other purposes.

Now that interest is being directed to the question of the effect of illuminants on colours, the apparatus shown by Tintometer, Limited, will have much additional interest among a new class of students.

The "Bennis" automatic carbon dioxide recorder and calorimeter are to be seen at the stand where they are showing an interesting collection of boiler-house plant.

Carl Zeiss, Limited, are exhibiting their new gas and water interferometer for the technical analysis of gases and water. It is a portable apparatus, and gives readings within limits that will satisfy the most scrupulous of experimenters.

Governors.

Messrs. James Stott and Co. are exhibiting their well-known forms of mercurial gas-governors.

The Foster Engineering Company have brought for inspection a good number of their gas-governors, by which uniform pressures can be maintained for incandescent burners, fires, stoves, &c., whatever may be the district pressure. The importance of constant pressure needs no emphasizing in these days; and the Foster governor is a means to that end.

Miscellaneous Exhibits.

The stand of Haughton's Patent Metallic Packing Company, Limited, must not be passed by without examining their engineering fittings for gas and chemical works. There are found here ammoniacal liquor cocks and valves, sulphate of ammonia plant fittings, acid connections, liquid elevators, heavy iron gland cocks and valves for gas-works use; also fittings for tar works and connections for tar stills. Pumps for gas-works are on view.

The Mond Gas Corporation, Limited, are exhibiting a model of their plant to gasify 100 tons of coal per day, complete with sulphate of ammonia and tar-recovery apparatus. Samples of sulphate of ammonia from coal and peat claim notice.

Messrs. John Ruscoe and Co. exhibit, among other things, a "Tuto" mechanical stoker and elevator, worked by one of their own make of gas-engines. They are also displaying a collection of their useful tools.

The Electric Exhibit.

As already stated, the electricity exhibitors have nestled themselves together in a small hall quite away from the main part of the exhibition. This is a matter for regret, as there is little space for visitors to make a proper inspection. But after examining the highly efficient heating appliances provided by the gas industry in the adjoining hall without any of that air-contaminating influence of which the electricians sneeringly speak, the visitor to the electricity apartment will, with his mind fixed on heating, compare the heating efficiency of the articles on view here with those in the adjoining hall, and arrive at the proper result that value is on the side of gas. Everything here seems on the diminutive scale—space, appliances, radiators, cookery demonstrations, restaurant, and even the Russian Orchestra which has been squeezed tightly into a corner. However, our competitors have done the best they could under the circumstances they themselves selected.

The "Electrician" says: "By the irony of fate, the electricity for cooking and heating demonstrations at the Smoke Abatement Exhibition is being generated by a gas-driven plant. Doubtless the 'Journal of Gas Lighting' will make all the capital possible out of this circumstance." Quoting the "Electrician" saves us the trouble of further reference.

Mr. and Mrs. Shadbolt "At Home."

Yesterday afternoon, the President of the Institution (Mr. R. G. Shadbolt) and Mrs. Shadbolt had an "At Home," in the reception pavilion, at the exhibition. It was a very successful function. About 100 ladies and gentlemen accepted the invitation—not only from the London and suburban districts, but from distant places in the Provinces. While the reception was proceeding tea was served to the guests, and altogether it was a very joyous company. The occasion afforded the opportunity for a reunion of many old friends; and conversation was animated. After the reception, most of those present inspected the exhibition; and in the evening the greater number were present to hear Professor Lewes's lecture.

Conferences and Lectures.

Conferences are being held to-day at 11 a.m. and 2.30 p.m.; Wednesday at the same hours; and Thursday, at 11 a.m. and 5 p.m. To-day "Smoke Pollution" is the topic; to-morrow, "Smoke Abatement;" and Thursday, "Law and Legislation." As previously stated, Professor Vivian B. Lewes was lecturing last evening [p. 867] on "The Relation of the Gas Industry to Smoke Abatement;" on Wednesday, Mr. Frank Bailey will lecture on "Electricity, Lighting, Heating, and Power;" and on Tuesday of next week at 8 p.m. Dr. J. S. Owens will give a lantern lecture on "Coal Smoke and Its Abatement."

SMALL WATER SUPPLIES.

From inquiries which have reached us from time to time, the need has been felt, especially by young engineers engaged in the study of water-works construction, of a work of convenient size and reasonable price which would assist them with some useful hints. There are several well-known excellent treatises on the carrying out of schemes for the supply of water; but for the most part they deal with works on an extensive scale. The subject of small water supplies, which presents problems essentially different from those met with in connection with large undertakings, has received little or no consideration in text-books. An attempt has now been made by Mr. F. Noel Taylor, of Dublin, to remedy this deficiency in the literature of water supply, by producing a book bearing the title at the head of this article.* His object has been to provide engineers, surveyors, estate agents, house owners, and farmers with a suitable guide in carrying out successfully small schemes for the collection, storage, and conveyance of water.

The author begins by dealing with the properties and sources of water. He points out their impurities, and explains the methods of testing for them. Turning to the sources of water, he first mentions rain, which, of course, is not palatable, and then comes to river water, the purity of which has to be ascertained by the methods he has described. However important rivers may be as sources of supply for towns, Mr. Taylor thinks their waters must "take a back place" for domestic use. He consequently turns to wells and springs; but he does not fail to point out the dangers of the water drawn from the former. A chapter is devoted to wells and well sinking; and then the subject of the flow of water in channels and pipes is taken up. As in the case of small water supplies it is very often found necessary to raise the water from its source, pumps and pumping are dealt with at some length. The water having been raised, the next question is its storage and distribution; and these are the matters considered in the next chapter, which completes the text. But there are two appendices, in which observations are offered on noises in water-pipes and on Abyssinian tube-pipes. There are 126 illustrations to the text, which is followed by an index.

Mr. Taylor has already published a "Manual of Civil Engineering Practice;" and he offers the present work to the younger members of the profession, in the hope that they may find therein information which may be useful to them.

* "Small Water Supplies. A Practical Treatise on the Methods of Collecting, Storing, and Conveying Water for Domestic Use in Large Country Mansions, Estates, and Small Villages and Farms." By F. Noel Taylor, C.E. London: B. T. Batsford. [6s. net.]

Mr. Taudevin on Industrial Gas Heating.—By inadvertence in the paragraph on "Industrial Gas Heating" in the "Journal" last week, a nought too many crept into the statement as to temperatures obtained in the modern type of natural-draught furnace of which Mr. E. P. Taudevin was speaking. This will, of course, have been recognized by readers, who will have interpreted the 13,000° C. to be 1300° C. The error occurred through the misreading of the degree sign in the copy for a nought.

THE RELATION OF THE GAS INDUSTRY TO SMOKE ABATEMENT.

By Vivian B. Lewes, F.I.C., F.C.S., of the Royal Naval College, Greenwich.

[A Lecture delivered last evening at the Smoke Abatement Exhibition.]

During the past few weeks, the efforts of the Coal Smoke Abatement Society have been ably seconded by the Miners' Unions; and as a result the country has had during this period the finest possible object-lesson as to the conditions which will exist a few generations hence, when our prodigal waste of the fuel supplies on which the supremacy of our nation entirely depends begins to fail—not from labour troubles, but from the extinction of the coal itself. The country will never have a better opportunity than exists at the present time for putting her house in order and inaugurating those reforms which alone can purify our atmosphere, and for lengthening the period which is to elapse before the fatal day when the working-out of the main seams raises the price of coal to such a point as to be prohibitive for many of the purposes for which we have been in the habit of using it.

Conserving our Coal Supplies.

The very abundance of our fuel supplies has been the cause of the reckless waste for which the country will pay bitterly in the future; and it is a duty we owe to posterity to do what we can to make up for the mistakes of the past by the most rigid economy in every branch of fuel consumption, more especially as by economizing in the proper way we can obtain better results than ever before, and fulfil our duty to the present generation by purifying our town atmospheres from the blighting influence of smoke, which in many large cities is but little short of a national disgrace.

In seeking for the right lines on which to start our reforms, we are forced to review the chief items of expenditure in order to see where the most telling economies can be effected. Among the mass of valuable information collected by the Royal Commission on Coal Supplies, none was of more importance than Mr. George Beilby's estimate of the uses to which the 236 million tons of coal that are annually brought to surface in this country are put. Expressed in percentages these are:

	Per Cent.		Per Cent.
Factories	22·97	Ceramic and chemical works	2·16
Domestic use	13·87	Metal and minerals	0·43
Iron, steel, and coke manufacture	12·17	Coasting steamers	0·87
Mines	7·80	Steamers over seas	7·25
Gas-works	6·50	Exported	20·35
Railways	5·63		

I confess that the first economy I should like to see attempted would be a 5s. tax on the last item, exempting the coal exported to our foreign coaling-stations. It is, however, with the first two items that our subject to-night chiefly deals, as the 36·84 per cent. debited to our factories and domestic use represents the coal that is responsible for most of the smoke that pollutes our town air.

The Factory Chimney.

It would serve no useful purpose to discuss the relative amount of smoke from the domestic chimney and the factory shaft, as this is dependent entirely upon locality; but while the shaft devotes its pollution to industrial centres, the chimney of our homes is doing its work throughout the length and breadth of the land, and, delivering its smoke at a lower level, is probably responsible for more actual damage to health and property than the factory shaft, which feeds the overhead gloom of the manufacturing district.

A considerable amount of attention has been given during the last twenty-five years to the combustion of coal on a large scale. The old ideas which many fuel consumers had of the necessity of smoke for economical combustion are being superseded gradually by rational processes; and many large manufacturers have found to their surprise that the cost of a smokeless shaft, as a rule, means a good balance on the right side. Automatic stokers, improved furnaces, and new ideas have made enormous advances possible of late years; and it has been so clearly demonstrated that smoky shafts mean faulty methods of working, that everything which can be done in the way of penalizing this nuisance is fully justified.

The Domestic Grate.

The domestic fire-grate, however, is a thing that has always been looked upon as too sacred to tamper with; and our methods of combustion for house-heating have been left far too much to the caprice of the individual, with the result that there has been but little improvement until quite within the last few years. We are still content to employ bituminous coal, and to utilize for heating purposes less than one-half of its calorific value, while the remainder is devoted in the form of smoke to the pollution of the atmosphere.

Before, however, we go into the question of the lines on which this side of the problem is to be attacked, it will be well to glance at the chemical and physical properties of smoke. and the causes that give rise to it. Bituminous coal, as we use it in our grates, consists of an agglomerate of vegetable residues, converted by time, temperature, and pressure into the body which we call "coal." Under the influence of heat, this breaks up, yielding, as the product of its destruction, solids, liquids, and gases; and it is the liquid products of the decomposition which give nine-tenths of the smoke that issues from our chimneys.

It needs no scientific knowledge to follow the actions which give rise to the formation of smoke. The fire has burnt down to a bright glowing mass, which is giving out by radiation a large amount of heat. But the bulk of the burning matter has become so small that fresh coal has to be fed on to it and to ensure not being troubled to do this again for an hour or two, a liberal allowance of coal is shovelled on to the surface of the glowing embers. The result of this is that the new charge of coal, heated from below by the red-hot fire, and cooled on its upper surface by the air drawn over it by the chimney draught, for a considerable period undergoes almost exactly the changes that take place when the same coal is retorted out of contact with air in a gas-works. Streaming from the upper surface, white vapours are first seen, which, if collected and analyzed, will be found to consist largely of steam, as well as of a gas very much in the nature of coal gas, and light hydrocarbon vapours. As the mass below gets hotter and hotter, jets of brown vapour mingle with the white, and very soon preponderate in quantity. If a piece of paper be held in this brown vapour, some of it will be found condensed on the paper as tar; while at the same time the gases which accompany it are of the same nature as coal gas, and the steam is growing less in quantity. It is during these early stages that the greatest loss of the heating material in the coal takes place, and the greatest amount of polluting matter is sent into the atmosphere.

Constituents of Smoke.

The popular idea of smoke seems to be that it consists of finely-divided particles of soot; but, so far, the smoke from the fire has contained none of these particles. Very soon, however, the mass on the fire has become heated to a high temperature, and a small flame breaks through a crevice in the layer of coal and ignites the escaping vapours above it, when there is obtained the bright flaring combustion of the tar vapour and gas which is one of the most pleasant features of the open fire-grate. The flame is brightly luminous, and emits a large amount of radiant heat; while towards the top of the flame it burns to a dull red, and soot particles are seen streaming from it in abundance. This stage of the combustion proceeds for a certain period; and the combustion becoming more and more perfect, the flame grows smaller and smaller in size and less sooty in its properties, and presently, when the coal has burnt through, a bright, clear fire is obtained which is now doing its best in the way of heat-radiation into the room. Little flame and less smoke are produced; and until a fresh charge of coal has to be fed on, the open fire is an ideal companion.

If, while we are noticing the changes in the fire itself, we were to examine the products that were passing up the cooler portion of the chimney above, we should find that until the fire had burnt clear we should have passing up the flue a mixture of steam, combustible gases, tar vapour, solid carbon particles on which tar was rapidly condensing, and particles of ash and dust drawn up by the draught in the chimney; and it is this mixture of many things to which we give the name of smoke.

If the same coal that we used in the fire had been destructively distilled in a gas-maker's retort, we should have obtained from it coke, coal gas, tar, and gas liquor—the latter being water which has absorbed ammonia and ammonia salts, together with other soluble bodies, during its condensation. If we take the coke, we find that it burns with little or no flame, and gives none of the constituents of smoke, with the exception of, perhaps, some steam and a little ash dust; while the coal gas we know we can burn in atmospheric burners in a gas-stove, also without the production of a trace of smoke. So that it is clear that the constituents of the coal which give the smoke are those which in gas making are left in the liquid products. We realize that if the gas manager were allowed to deal first with our fuel supplies, and, after removing the tar, were to supply us with the coke and gas as fuels, we should have solved at once the problem of coal smoke abatement.

Overcoming Prejudices.

It seems so simple a solution of the whole question, that wonder naturally arises in our minds that it has never been generally adopted. But some inducement stronger than smoke abatement is needed to overcome the prejudice of years which, rightly or wrongly, exists in the mind of the public against the use of gas coke and coal gas as domestic fuels. When you fervently urge the claims of these combustibles, you are met at once with the reply that gas coke burns without flame, is difficult to ignite, gives off noxious fumes, and that the fire is dull and cheerless; while your advocacy of gas is, in the same way, met by the statement that it is so much more expensive than coal.

These objections, like most prejudices, have a small modicum of foundation in fact. During the last fifty years, the temperatures employed in the distillation of coal for the manufacture of gas have been pressed so high that everything that could be volatilized out of it has been given off, with the result that the gas coke has consisted of little else than the carbon residues from the coal bodies and the ash that was in the original coal. We find by experience that the ease with which any carbonaceous material ignites, and the rapidity with which it burns and gets raised to incandescence, is dependent largely upon the presence in it of what we call volatile matter—that is to say, substances which can be driven off under the influence of heat; and if these be present, the gaseous bodies ignite as they escape from the coal at a lower tem-

perature than the substance itself, and on their combustion heat the more resistant residual up to its ignition point, at the same time carrying the combustion on brightly through the mass. If no volatile matter is there, the ignition-point is high, and the combustion so slowed down that it is difficult to obtain the cheery brightness that we require from a fire.

Coke for Domestic Uses.

In the early days of gas manufacture, when iron retorts were used, the temperature that could be employed was comparatively low; the consequence being that the coke still contained a certain proportion of volatile matter, and formed an excellent domestic fuel. When, however, iron retorts were discarded in favour of fire-clay, the gas manager, desiring to make the largest volume of gas that he could, and looking upon coke as a bye-product, pressed the heats to so high a point that the volatile matter left in the coke rarely exceeded 1 per cent.; and the prejudice against coke began to retard its use, save for horticultural work, small manufacturing processes, and central heating. If only we could get coke which, like the old iron-retort coke, contained 5 or 6 per cent. of volatile matter, we should have a perfect domestic fuel, which would not only give considerably more heat than bituminous coal, but would also do away with the pollution of the atmosphere.

The Merits of the Open Fire.

There are many reformers who strongly advocate the use of slow-combustion stoves of the kind employed on the Continent, and with anthracite in America; but I will confess at once that I look upon these as abominations. It is always urged in their support that they will give more heat per pound of coal consumed than can be obtained from 6 or 7 lbs. of coal in the open grate; but although heat economy is an important factor, there are many other things to be considered. The open fireplace, although undoubtedly wasteful in the extreme, is not only the most pleasant, but also the most hygienic, method of heating, as nearly the whole of the heat conveyed from the burning fuel to the room is due to radiation, which, leaving the atmosphere comparatively cool for breathing purposes, warms the solids and walls of the room, which, in turn, impart some of their heat by convection to the air; so that one always has the walls and the solid articles at a higher temperature than the air itself.

The slow-combustion stove, on the other hand, heats the room almost entirely by raising the temperature of the air in contact with the stove, which sets up convection currents, with the result that the air becomes oppressively hot; while only a portion of its heat is imparted to the walls. So that if one is sitting near a wall, under the ordinary laws of radiation, the body, which is at 98° Fahr., radiates heat to the wall, which is probably not above 60° to 65° Fahr. This local loss of heat produces a feeling of chill, and practically the same results upon the system. At the same time, one is breathing air oppressively warm, which contains, per cubic foot inhaled, a less weight of oxygen than it would had its temperature been lower. The result of this form of heating can be judged by the effect it has on the growing plants in the room, which will be found to droop rapidly, owing to the fact that raising the temperature of the air gives it a greater power of holding up water vapour, which therefore evaporates from every exposed surface. Nor must it be forgotten that the open fireplace is a very important engine of ventilation—many thousand cubic feet of air per hour being withdrawn from the room, to replenish which fresh air is drawn in from outside. Although this is not the best method of ventilation, still it undoubtedly makes the room more healthy; so that if it were only its wastefulness in fuel that we had to bring against the domestic open fire, we might place against the loss the work it is doing as an engine of ventilation.

The past twenty years have seen many improvements in the domestic stove, both in the arrangement of the grates themselves and in the way in which air is supplied to the burning fuel; and this has resulted in the reduction of nearly one-half of the fuel that used to be consumed in the old-fashioned grates, in which it was not an unusual thing to find 7 or 8 lbs. of coal being burnt per hour—now reduced to 4 or 5 lbs.—to warm a fair-sized room.

Grates, however, do not wear out very fast; and it is only in new houses that the more modern forms have been adopted, as the capital outlay necessary to take out the existing stove and fit in one of modern type as a rule deters the householder on the ground of expense.

Smokeless Combustion Grates.

Many forms of grate have been introduced which were intended to give smokeless combustion; but smoke once formed is extremely hard to get rid of. The under-fed stoves, in which the top of the fire is kept bright and clear and the fresh coal is introduced at the bottom—the smoke-yielding constituents undergoing decomposition in the mass of incandescent fuel—are the best of them. Though Arnott first introduced the idea over sixty years ago, this form of stove has never become popular; and the examples of them to be found are few and far between. At one stall in the exhibition is to be seen a new adaptation of this idea, which I hope, from its simplicity, may obtain a more extended trial than any of the stoves that have gone before.

Gas Undertakings and Coke Fuel for Existing Grates.

Personally, I do not think that, however good the form of grate introduced for this purpose, it would become widely adopted, unless the consumer was made to feel that the capital expenditure necessitated by its introduction was in the long run a saving of money, as well as tending to the purification of the atmosphere. I have long felt that what we want really to solve the question is that the gas manufacturer should improve the quality of his coke until its characteristics were of the same kind as those which were fully appreciated by that section of the public who tried Coalite a few years ago; and if only the gas companies would lay themselves out to make a domestic fuel containing 4 or 5 per cent. of volatile matter, they could very easily make a fuel that would oust bituminous coal from our homes, and at the same time make as large a volume of gas per ton as they do at present.

What is wanted is to fit the fuel to the existing grate, not to make the consumer go to the expense of fitting the grate to the fuel. If you can show a householder that you can give him a fuel which is as cheap as the coal he is using, and that can be burnt in the same grate and give him more heat but no smoke, he will become a smoke reformer; but let him feel that it is costing him a penny more than he has been in the habit of paying, or is in any way affecting his comfort, and smoke abatement has no interest for him.

If only gas companies would seize the present opportunity, and, while the whole country is disgusted and enraged at the treatment they have received at the initiative of the Miners' Unions, start a crusade in every town of the kingdom, and demonstrate what can be done with good coke and coal gas, at the same time using their utmost endeavours, to improve the burning quality of their coke to fit it for domestic requirements, it would be a revelation to the world of the relation of the gas industry to smoke abatement.

Nearly the whole of the prejudice that exists against coke as a domestic fuel is due to excessive heats during carbonization, which makes it hard to ignite, and, for the same reason, makes it dull in burning; while the absence of flame causes a cheerless appearance and a poor draught in the chimney, so that a trace of sulphurous fumes is liable to escape into the room. The whole of these objections would disappear if a small percentage of volatile matter were left in the coke.

Superiority of Coke over Coal.

Even under existing conditions, the superiority of coke over coal in the amount of heat radiated as useful heat from the grate into the room can easily be shown. A pound of coal and a pound of coke have just about the same heat value, as judged by the thermal units they can be made to develop on burning; but you cannot burn coal completely, because it decomposes below its ignition-point, and a large percentage, therefore, of combustible vapours and gases escapes unburnt, with the result that barely one-fifth of the heat value of the coal is obtained as radiant heat in the room, the remaining four-fifths going up the chimney in the hot flue gases as unburnt vapours and solids. With coke, on the other hand, when once alight, it is entirely burnt on the grate, no unburnt gases escape, and the loss is only in the hot products of combustion escaping up the chimney; the amount of heat radiated into the room being from two to three times as great as from a pound of coal.

These are the points which every gas manager should impress upon the public. The public want to know them; it is to their interest to do so. If a householder finds he can get twice the heat at less cost, he will take a little trouble to learn how best to burn coke; and every gas company should demonstrate to him how to do it, and see that his flues and registers are in proper order.

Some lethargic gas managers will tell you that they do not want to push the sale of coke, that they can sell all they make, and that if they created a demand for larger quantities they would be making more gas than they require. When the facts are examined, it is generally found that the price of gas is high and in consequence the demand low; but if they pushed their coke market and made good coke; they could command a price for it that would enable them to reduce the price of gas and largely increase their output. It is perfectly true that the sale of gas and coke must proceed *pro ratâ*; and I have often wondered that some of the more advanced gas managers have not revived the idea put forward by Sir William Siemens thirty odd years ago of using a coke-fire fitted with a gas-bracket at the side, so that the gas-burner can be swung forward, and the gas burnt in the coke until it was well alight and incandescent, and the gas then turned off and the bracket swung back clear of the fire to prevent ash falling into the holes.

A most efficient fire may be made by putting a fire-block at the back of the grate, so as to prevent too thick a mass of coke, and using a bracket with a perforated pipe to swing into position between the lower bar and the bottom of the grate. An atmospheric burner is not needed—the jets of gas getting all the air they want in passing through the coke, and a hot, bright fire is the result.

The use of low-temperature coke and coal gas is a subject which I have gone into so often that my views are well known; and I feel sure that it is the readiest solution of the smoke problem.

It is quite clear that to obtain economy in the use of coal it is impossible to multiply processes. One must take an already well-known and well-equipped industry, such as that of gas manufacture, and show them that it is to their advantage to provide the public with what is wanted, and to treat their coke as a product of destructive distillation which is quite as important as the coal gas to which they have devoted their whole attention.

If this could be done, it would very soon lead to practically the whole of the domestic fuel supply coming to the public through the medium of the gas-works, the function of which would be the withdrawal of the smoke-forming tar, the recovery of ammonium sulphate from the nitrogen in the coal, the production of gas and of domestic coke. The advantages that would accrue if this could be done are enormous not only to the public, but to the coal workers and the gas companies.

All the time that the public use bituminous coal as a domestic fuel, they will be at the mercy not only of the miners and the Miners' Unions, but of what is far more important—that generally overlooked factor, the coal merchant. If the domestic fuel supplies came through the agency of the gas-works, large forward contracts would be made with the mine owners; and the interested agitations got up by the Unions among the miners would be far less likely to have the disorganizing effect upon the public comfort that at present exists, when at the slightest hint of labour troubles the merchant forces up the price of his stock to a point which enables him to make a fortune, while the miner is starving and the public are victimized.

Lessons of the Coal Strike.

Unless we are perfectly blind to our own interests, the teachings of the present coal strike must sink deeply into our minds. We see coal being forced up to a prohibitive price, labour coerced into starvation by the methods of paid agitators, while at the same time our only relief is coming from the coke and gas which in London we are obtaining at practically no increase in price; and if only we had the sense to learn the lesson which this condition of things is teaching us, the present coal strike may prove one of the greatest blessings the country has ever experienced.

The Part Played by Gas-Stoves.

No one can walk through this exhibition without being struck by the enormous advance in beauty and efficiency of the gas-stove exhibits. There is no doubt that the great increase which the present century has already witnessed in the consumption of coal gas as a fuel has had a marked effect on the purity of the air, and that the yellow fogs we have had in London during the past twelve years have been only a small fraction of the number experienced in the closing twelve years of the last century. Of course, climatic conditions may have had a good deal to do with this; but I think the gas-stove may claim the lion's share of the credit.

Gas fires, cookers, gas water-heaters, and gas-engines all have been developed to a point which leaves no valid excuse for overlooking their claims; and ever since Bunsen, in the early fifties, gave us the atmospheric burner, in which non-luminous combustion is obtained and smoke rendered impossible, coal gas has progressed steadily in favour for heat and power as well as light, until at the present time nearly as much is used for the one as for the other.

What, then, stands in the way of its universal adoption? First and foremost, initial cost crops up, as, although much has been done by the companies in popularizing gas-stoves by letting them out on hire, by easy-payment systems, and by looking after their maintenance, the consumers must pay something, and that is sufficient to damp their ardour as smoke reformers. Secondly, gas is a little more expensive for continuous heating than coal, although when used for short periods, as for fires in bedrooms, &c., the fact that you turn it on when you want the fire, and turn it off when it is done with, brings the fuel cost to nearly the same as coal; while in such places as Widnes and Sheffield, where the price of gas has been reduced to a minimum for heat and power, the gas-engine and gas-fire well hold their own.

In considering the cost of gas-fires as compared with coal, the usual method adopted is to argue that as a pound of coal contains on an average about 14,000 B.Th.U., and it would take 25 cubic feet of London coal gas to give this heat value, the cost of the gas-stove will stand to the cost of the coal-grate in the ratio of one pound of coal to 25 cubic feet of gas. In the district in which I reside, the gas costs 2s. 2d. per 1000 cubic feet; so that 25 cubic feet cost 0·65d., while one pound of coal at 25s. per ton costs only 0·13d., which would make gas five times the cost of coal.

This is absurdly wrong. Personally I use more gas-fires than coal-fires, and for an equal amount of heating find very little difference in the cost. The reason is that, as we have seen, we get only one-fifth of the effective heat of the coal utilized; so that if we used gas in a flueless stove or radiator, which utilizes the whole heat in the room, the cost would be equal as regards raw material. These forms of stove, however, should never be used except in a hall or large building where there is plenty of air space. In a dwelling-room, the products of combustion must be taken by a flue into the chimney; and under these conditions good gas-stoves should give 35 per cent. of the calorific value of the gas as radiant heat, and 25 per cent. as convected heat, so that 60 per cent. is utilized, or three times as much as with coal. If one takes into consideration the labour expended in the use of coal and grate cleaning, and the economy of lighting the gas-stove when you want it and turning it out when done with, it will be seen that the difference is very small; and with coal at its present price, it is a lucky household that has only gas-stoves.

I think I have said sufficient to show that, in my opinion, the relation of the gas industry to coal smoke abatement is of the closest character, and that it will be on the lines I have pointed out that this great work will be done. The first factor, however, towards success is to get rid of bituminous coal in the domestic grate. It is quite clear that trying to coerce, or even reason with, the British consumer is perfectly useless. He has been brought up to use bituminous coal, and he will continue to burn it until he finds that it is touching his pocket; and if the Chancellor of the Exchequer, when next in need of a new tax, would put 5s. per ton on the coal retailed for domestic supply and exportation, exempting that exported to our foreign coaling-stations and used in coke-ovens and gas-works, the abolition of smoke would follow within five years, and the waste of coal would be reduced to a point that would ensure a supply of this all-essential commodity for at least another generation—longer than it will last at the present rate of consumption.

SOME AMERICAN NOTES.

[From a Correspondent.]

It will be a long time ere the winter now coming to an end is forgotten by the distribution employees of most of the gas companies situated east of the Rocky Mountains and north of Mason's and Dixon's line—the famous division line between the northern and southern sections of the United States. We have had a very cold January and February, accompanied by little snow. In Philadelphia, for example, where the average mean temperature for six weeks was 23·8° Fahr., only one colder period of approximately the same length is known to the Weather Bureau, whose records begin in 1871. This was in 1875; and the mean then was 23° Fahr. The combination of bare ground and of low thermometer produced frost depths practically previously unknown here. Where before 17 inches of frozen ground was considered average and 24 inches abnormal, averages of 29 inches were experienced, and many depths of 36 inches found. The average cover over gas-mains in this country is 36 inches. Also, there are still in use many miles of cast-iron mains 2 inches diameter, and hundreds of miles of 3-inch mains. Of 4-inch mains, both old and new, the mileage is in the thousands. The effect of the abnormal frost depth in breaking mains of the above sizes may be judged by the statement that in six weeks over 300 breaks of 2, 3, and 4 inch mains occurred in 600 miles of these sizes, forming part of a distribution system of 1500 miles. This was more than double the largest number previously recorded, and six times the average for ten years. In addition, of course, there were the leaks due to leaking main-joints and leaking services; such leaks being over 1000 in number. Each leak or break required for its detection and repair many bar-holes and several openings; the latter slowly made through earth frozen to the hardness of rock. Small wonder that gangs were working night and day, and that many employees laboured nearly eighteen hours out of every twenty-four for a fortnight at a time. One day, in a city of 670,000 inhabitants, there were received over 100 complaints traceable to street leaks. At that time, the frost so completely surrounded the mains that the ordinary method of "barring" to locate the leak before digging met with little success, because no gas could travel along the main through the frozen ground.

I have just touched on a situation as to which the space at my disposal will not allow more than this mere suggestion of what has occurred. It was accompanied in many cities by thousands of complaints of frozen services and house-risers. For instance, in Chicago, where for thirteen consecutive days the thermometer reached 0° Fahr., there were for about a week 7000 "no-gas" complaints daily. The heavy burden was borne quite bravely; and again our gas companies have shown that they are both willing and able to satisfy the requirements of their positions as "public service" companies. However, the memory of the struggle will not soon be forgotten; and let us hope many years may elapse before its mate arrives. In the meantime, the advantages of laying no main smaller in size than 6 inches, and of having a cover of even more than 3 feet, are very apparent to our distribution engineers.

With our street-leak troubles receding as the weather moderates, the scene of possible trouble shifts to our manufacturing departments. We are facing a probable strike on April 1 of all the anthracite miners. The resultant shortage of this coal will affect many of the carburetted water-gas plants. However, a similar strike in 1902 forced these plants to the use of coke; and while at that time the lack of familiarity with this fuel resulted in an embarrassing diminution in manufacturing capacity, since then experience has shown how to obtain with coke capacities superior to those formerly secured with coal. Consequently, now the kind of fuel used, whether anthracite coal or coke, is mainly a question of price. Nevertheless, as many other industries will turn to coke if hard coal cannot be obtained, while our strike will undoubtedly not last long enough to shut-down any carburetted water-gas plant, it may cause much anxiety on the part of those responsible for maintaining the fuel supply. They should take consolation from the fact that the output of their companies is being largely increased; for this strike, by depriving us of our household fuel, will put all the gas-ranges in action, and make sales increases of 10 per cent. and over quite common. They should also realize how much more serious is the situation now being faced by their British brethren. Let us hope that before these words will reach "Journal" readers, your strike will have become only an ugly memory of the past.

A GAS-COOKER OF NOVEL CONSTRUCTION.

An Oven Enveloped in Heat—Temperature and Cooking Results.

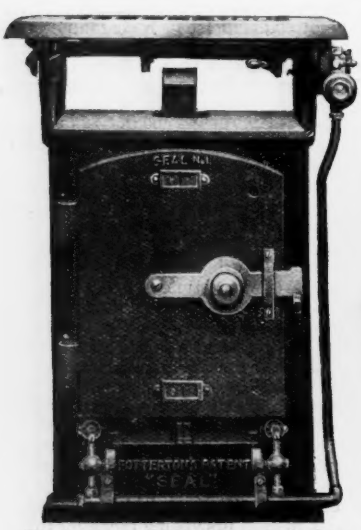
For some years, the principles of gas-cooker construction have remained unchallenged and unaffected; and there appears to have been common acceptance that the ultimate goal had been reached, although there has been general recognition of the fact that, economical and convenient as the gas-oven is, there was still plenty of margin in the thermal value of the gas used for raising the temperature efficiency of the ovens. Recently electric ovens have been introduced, by the use of which the manufacturers, with a few electricity station enthusiasts, claim that there is a saving in the "meat" baked in them as compared with other methods of baking. There is no secret about all this. By any system of slow baking in closed ovens without vent (restraining to some degree the evaporation of the water contained in the meat), the weight represented by evaporation can be lessened. By the use of suitable baking-tins or casseroles which completely enclose the joints, and an ordinary gas-oven, precisely the same effect can be secured. But Mr. Thomas Potterton, of the Cavendish Works, Balham, S.W., has, after considering the claims of the electricians as to the advantages of meat baking in an enclosed oven, designed and patented one for the use of gas as the fuel, which he describes as "a cooker embodying all the advantages claimed for electricity, and at a less cost for cooking." Mr. Potterton has called the oven the new "Sealed-Oven" cooker; and there is no question as to the novelty about it, and the good results that can be secured with it, judging from the authoritative results of tests that we have at hand.

The casing of the new oven is a strongly made one, and heavily packed, so as to prevent outward radiation. Then there is an inside casing; and this, being slightly removed from the outer casing, forms a free space (external to the inner oven) for the travel of the heat from gas-flames burning in two chambers at the sides of the bottom part of the oven. The air-channels leading to these burner chambers are seen in the illustrations in front below the oven. A point affecting safety is that the gas supply cannot be turned on until the doors covering the air-channels are opened. When the gas is lighted, the heat from the flames takes a zig-zag course throughout the space, so as to put to useful work as much of it as possible—the products of combustion finally passing away at the flue-pipe. The effects produced by this form of oven construction are several; but the main ones are: Gas is not burning within the oven; spurting fat will not therefore come in contact with the flames, causing a disagreeable smell; and, the oven being enclosed, when cooking meat, evaporation will be retarded and lessened, so that, when the cooked meat is weighed, it will show to better advantage in respect of loss of weight by evaporation than when baked in an open tin in a ventilated oven, with direct heating.

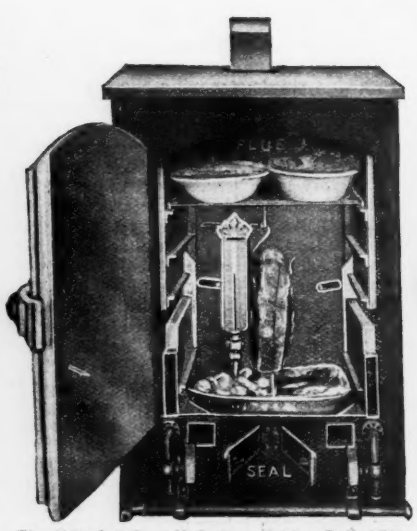
Other points affecting economy are these: Mr. Potterton's tests assure him that less gas is required to reach given temperatures with his oven than with an ordinary one; and he also maintains that the electric oven proves, and his own experiments with the new oven confirms this, that cooking has hitherto been done in gas-ovens at too high temperatures. As a matter of fact, his experiments have converted him from the orthodox opinion that, in baking meat, the oven should be heated up before putting in the meat He maintains that it should be placed in the oven when lighting the gas. The flap-doors outside the bottom of the oven that are open, and so uncovering the air-supply holes when the gas-burners are alight, can, as soon as the gas is turned off, be closed; and this prevents any cold air circulating through the heat-envelope of the interior casing. In other words, the space becomes air-locked. The result of this is that the temperature of the oven is maintained at a height that will enable cooking to proceed, or the heat of the oven be otherwise usefully employed, for a considerable time after the gas is extinguished. The tabulated temperature tests will show this effect; and the inventor claims that these completely demonstrate the temperature economy of his method of oven construction.

As the highest temperature is at the bottom of the oven, the best place for meat to be cooked is in this part; and by the aid

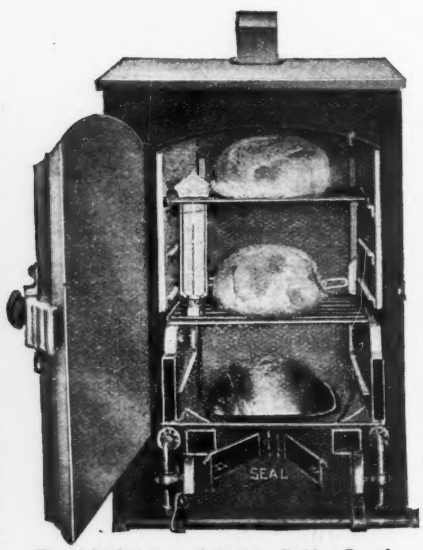
The Parts of the "Sealed-Oven" Cooker.



The Potterton "Sealed-Oven" Cooker.



The "Sealed-Oven" Cooker, Baking Rolled Ribs of Beef, Potatoes, Batter Pudding, Rice Pudding, and Apple Tart; also showing Test Thermometer in Oven.



The "Sealed-Oven" Cooker, Baking Bread; also showing Test Thermometer.

of a shelf at the top of the oven, puddings, tarts, and pies can be baked there at the somewhat lower temperature. With the even heat that is maintained right across the top of the oven, the outer parts of the puddings or pies become beautifully and uniformly browned. In the case of baking bread, we are informed that three 2-lb. loaves can be well baked in 45 minutes. All that is required is to heat the oven to 420° Fahr. before putting in the bread, and then, during the period of baking, the loaves are changed from their original positions in the oven; so that they are all dealt with alternately at the higher and lower temperatures.

The new cooker is made in three sizes; and every vital part is detachable and interchangeable, so that cleaning and maintenance are facilitated in a manner that will be appreciated by both householders and the managements of gas undertakings.

Consumption and Temperature Tests.

Turning now to the comparative temperature tests. These were made on an ordinary cooker and a No. 1 "Sealed-Oven" gas-cooker; a separate meter being used for registering the consumption of the gas. It will in this connection be remembered what has been said as to Mr. Potterton's views on the subject of high temperatures being wasteful in baking; and the temperatures shown here are merely comparative, but actual, ones at specified consumptions of gas. In the first test, the figures in parentheses represent twenty-minute intervals. It will be observed that, in the "Sealed-Oven" cooker, midway in the test period the consumption of gas was reduced from the rate of 17 cubic feet per hour to 9 cubic feet; so that 18 cubic feet of gas were used in the hour and twenty minutes, against 24 feet in the same time by the ordinary cooker that was employed. Yet the temperatures were maintained at a higher figure in the former than in the latter.

Gas lighted, 9.15 a.m. Atmospheric temperature, 40°

ORDINARY COOKER.

Gas consumption, 17 cub. ft. per hour, at 47-10ths.

		Oven Temperature.
(1)	6 cub. ft. of gas consumed	290°
(2)	6 " "	360°
(3)	6 " "	390°
(4)	6 " "	412°

After running one hour at 17 ft. per hour, the above oven registered 440°.

POTTERTON'S COOKER.

Gas consumption, 17 cub. ft. per hour at 47-10ths.

		Oven Temperature.
(1)	6 cub. ft. of gas consumed	282°
(2)	6 " "	460°

Gas reduced on this cooker only to 9 ft. per hour.

(3)	Temperature of oven	448°
(4)	" "	445°

After running an hour at 9 ft. per hour, the oven registered 450°.

The gas pressure was then reduced to 29-10ths on both cookers, with the following results:—

ORDINARY COOKER.

Temperature of oven after one hour at 15¾ cub. ft. gas consumption . . . . . 410°

POTTERTON'S COOKER.

Temperature of oven after one hour at 7 cub. ft. gas consumption . . . . . 400°

The gas pressure was again reduced to 13-10ths on both cookers:—

ORDINARY COOKER.

Temperature of oven after one hour at 11½ cub. ft. gas consumption . . . . . 330°

Gas shut off.

Temperature of oven after one hour . . . . . 107°

POTTERTON'S COOKER.

Temperature of oven after one hour at 5⅝ cub. ft. gas consumption . . . . . 340°

Gas shut off.

Temperature of oven after one hour . . . . . 140°

Cooking Space in Ordinary Cooker.

19 in. high, 14½ in. wide, 12 in. deep.

Potterton's Seal No. 1 Cooking Space.

20 in. high, 13¾ in. wide, 13 in. deep.

The next set of tests with an ordinary and a Potterton's No. 1 sealed oven are especially interesting as showing the temperature after the gas was extinguished.

Atmospheric temperature, 48°. Gas pressure, 29-10ths.
Gas lighted, 3.5 p.m.

ORDINARY COOKER.

6 cub. ft. of gas consumed . 330° .. 16½ cub. ft. per hour
6 " " " . 402° .. " " "

POTTERTON'S No. 1 SEALED OVEN.

6 cub. ft. of gas consumed . 320° .. 15½ cub. ft. per hour
6 " " " . 480° .. " " "

Gas turned out, and both oven doors open to cool ovens.

Gas re-lighted at 5 p.m., both ovens still slightly warm.

ORDINARY COOKER.

6 cub. ft. of gas consumed . 305° .. 16 cub. ft. per hour
6 " " . 390° .. " "
1 hour later . . . . . 445° at 16 cub. ft. per hour

POTTERTON'S No. 1 SEALED COOKER.

6 cub. ft. of gas consumed . 342° .. 16 cub. ft. per hour
6 " " . 500° .. gas now reduced to 8 ft. per hour
1 hour later . . . . . 415° at 8 cub. ft. per hour

Gas turned out.

ORDINARY COOKER.

½ hour later . . . . . 170°
½ hour later . . . . . 110°

POTTERTON'S No. 1 SEALED COOKER.

½ hour later . . . . . 245°
½ hour later . . . . . 160°

The last figures, illustrating the manner in which the heat is retained, are notable.

Cooking Tests.

Now we come to representative cooking tests that have been made; and the loss by evaporation will be particularly noticed, in view of the claims recently made by the makers of electric cooking ovens.

Leg of Mutton Test by Expert with No. 1 "Sealed-Oven" Cooker.

Gas pressure, 15-10ths. Temperature of room, 50° Fahr.
Leg of mutton, 4 lbs. 12 ozs., placed in cold oven.

		Oven Temperature.	Gas Consumption.
Gas lighted	2·11 p.m.		
	3.11 "	360°	8½ ft. per hour
	3.40 "	400°	14 ft. consumed

Meat taken out, well done.

Weight of meat after being cooked: 4 lbs. ½ oz.—loss, 11⅛ oz.
Weight of dripping, 4½ oz.

Bread Test with No. 1 "Sealed-Oven" Cooker.

Gas pressure, 20-10ths. Temperature of room, 51° Fahr.

Bread baked: Three 2 lb. loaves—one at bottom in tin; one in centre in tin; one at top in tin.

Gas consumption, 10 cub. ft. per hour.

		Thermometer in Oven near Bottom.	Thermometer at Top of Oven.
Gas lighted	11.7 a.m.		
	12·7 p.m.	380°	210°*
	12·37 "	450°	260°* 15 ft. gas

Bread taken out of oven.

* In cooking, the bread at top of oven spread over thermometer stem, so that thermometer gave temperature of bread.

Leg of Mutton Test with No. 1 "Sealed-Oven" Cooker.

12.41 Leg of mutton, 4 lbs. 6 oz., placed in hot oven.
1.14 Temperature at bottom, 375° Temperature at top, 360°
Gas out 1.41 " " 410° " " 375°

10 cub. ft. of gas consumed.

Meat weighed after being cooked 3 lbs. 11 oz. Dripping, 4 oz.

	Temperature at Bottom.	Temperature at Top.
½ hour later	230°	245°
1 hour later	150°	175°

Meat well done outside, underdone in centre.

Note: This test was repeated, using 11 ft. of gas in 1 hour 20 minutes, and gave satisfactory results.

Cooking Test by Experts with the "Sealed-Oven" Cooker.

Gas pressure, 28-10ths.

Ribs of beef, weighing 5 lbs. 10½ oz. before being cooked, placed in cold oven.

Gas lighted.
3.49 p.m. .. Meat placed in oven.
4.49 p.m. .. Oven temperature 250° .. 8 cub. ft. of gas consumed
5.59 p.m. .. " " 315° .. 16 " " "

When 18 cub. ft. of gas were consumed, the beef was taken out of oven.

Weight of beef after being cooked, 4 lb. 12 oz. + weight of dripping, 5 oz. = 5 lbs. 1 oz. Loss in cooking, 9½ oz.

American Gas Institute News.—In the "Journal" for the 13th ult., it was mentioned that the American Gas Institute had commenced the publication of a "Bulletin" with the above title. The original intention was to issue it at intervals during the year; but the first number was so well received that it has been decided to publish monthly. Gratifying evidence of the influence of the "News" has been afforded by several applications being sent in for membership of the Institute. The present number contains some useful answers to questions as well as several "wrinkles." It is stated that the proceedings at the last annual meeting were so heavy, that it is necessary to have two volumes of "Transactions" to contain them.

THE ILLUMINATION OF PRINTING-WORKS.

At the Meeting of the Illuminating Engineering Society last Tuesday, at the Royal Society of Arts, two papers were read on the above subject. The first dealt with the illumination of such establishments by gas; the author being Mr. F. W. Goodenough (the Chairman of the Society). The second treated of the use of electricity for similar purpose; the author being Mr. Justus Eck. As Mr. Goodenough was a reader of a paper, Mr. Haydn Harrison presided.

MR. GOODENOUGH'S PAPER.

In this paper, I have endeavoured to place before you some data which have been obtained respecting a few gas-lighting installations in printing-works. I would like, however, to point out at once that the results are not put forward as bearing on every aspect of the many-sided problem under discussion. They are merely a few notes of some observations that have been made from time to time, and which may be of interest to members of this Society.

Variable Conditions.

Circumstances vary so much in printing works that it would need a very extensive investigation to take every aspect of the question into account. It is doubtful if there exists another form of industry in which good lighting has more effect on the successful running of the concern than is the case in the printing trade. The work carried on, and the conditions that have to be met, are of a peculiar character; and one is sometimes inclined to think that the owners would find great advantages from removing or reconstructing a works altogether. It too often happens that printing works are surrounded by high buildings which blot out the sky—thus necessitating the almost continuous use of artificial light. Another constructional feature frequently encountered is the comparative lowness of the ceilings, which is by no means an advantage from an illuminating engineering point of view, nor from any other. It is worthy of note, however, that most printing-works' managers now perceive the advantages to be derived from the generous use of whitewash, which is cheap, and conduces to bright and sanitary conditions for the workmen.

Many printing establishments, of course, find it necessary to do a large amount of work during the night. In such cases, it is of great importance that care should be bestowed upon the artificial lighting installation. Again, the work is often carried out against time, which further emphasizes the need for good lighting.

As bearing on the question of the deficiency of natural lighting that is sometimes met with, fig. 1 is interesting. The two compositors' frames alluded to were in the same room. In one case a fair amount of sky area was visible; but in the other case the amount was very small. The observations were made at midday, with a fairly bright sky, and on the actual working surfaces of the frames. Compositors were working at both frames, and appeared to be quite able to do their work satisfactorily. I just mention this in passing as an interesting practical example of the great adaptive power of the eye; it is no part of this paper to deal with the problem of daylight illumination. Again, fig. 2A shows the illumination found upon the inspection board of a ruling machine in a basement workroom. Artificial illumination was, of course, continuously employed.

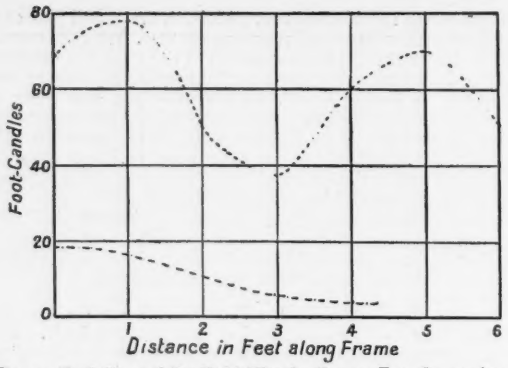


Fig. 1.—Variations of Daylight Illumination on Two Composing Frames in the Same Room.

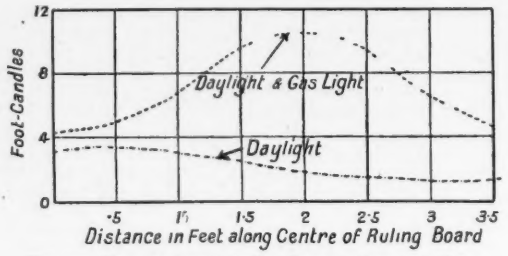


Fig. 2a.—Illumination of Ruling Board; Obscured Globe.

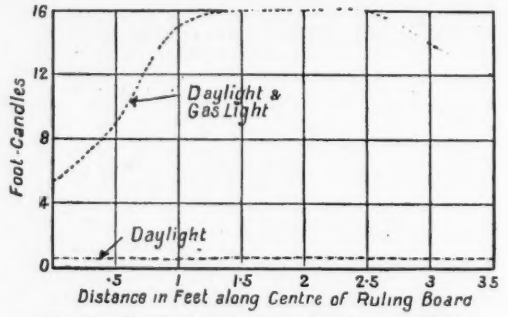


Fig. 2b.—Illumination of Ruling Board; Clear Globe.

The style of gas lighting that has found great favour in printing-works is what has been called "point lighting"—*i.e.*, by means of small units under separate control; and it appears that the system is justified on the following grounds:

(1) The special requirements of each particular machine and workman may be met to some extent.

(2) Out of a number of machines or benches it may happen

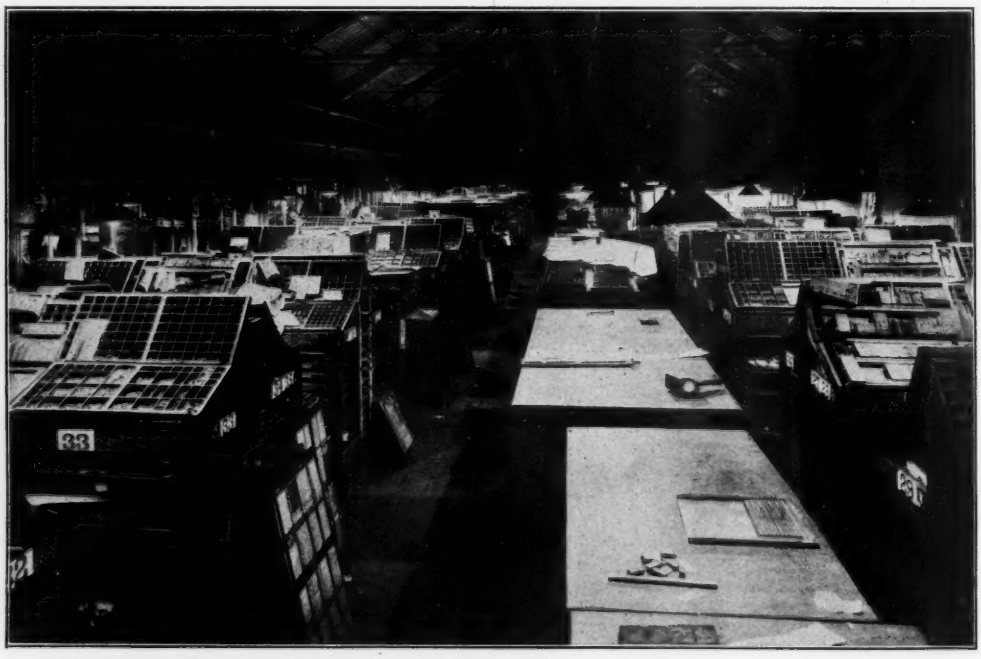


Fig. 3.—Illumination of Composing Frames at Cassell and Co.'s.

Fig. 4.—Illumination of Composing Frames at the Solicitors' Law Stationery Society.

that only one is in use. Point lighting conduces to econony in gas consumption by making it possible for lamps that are not required to be extinguished.

In exploring the illumination of any works, it is interesting and highly instructive to ascertain the ideas of the workmen in regard to the lighting. One is sometimes a little startled by a workman stating that he prefers to see a bright light, and will use clear glass in preference to the obscured type. On the other hand, many workmen endeavour to supply the omission of the lighting engineer by attaching little aprons of paper to the edge of the reflector, to screen off the glare. Considerable ingenuity is sometimes exercised by the men in their endeavour to make good the omission. It sometimes happens that sufficient care is not exercised in selecting the best form of reflector for a given purpose. A comparison from this point of view is seen in the two photographs (figs. 3 and 4) taken at the premises of Messrs. Cassell and Co. and the Solicitors' Law Stationery Society respectively. Fig. 3 shows what is clearly the better installation of the two, because it combines good illumination with a total absence of glare. Glare such as that shown in fig. 4 is not serious; but it should, I think, be avoided, especially as this can easily be done.

Illumination of Composing-Frames.

The illumination of composing-frames is probably the most important aspect of printing-works lighting. The work that is performed there and on the "stones" demands a high visual effort; and therefore good and suitable lighting. One is often struck by the great difficulty in defining what "adequate illumination" should be. The difficulty is, of course, due to the great power of adaptation of the eye and to the variety of work carried out. Fig. 5 is an illustration. It shows how the illumination on

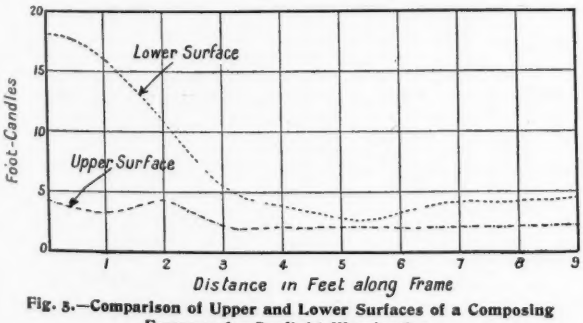


Fig. 5.—Comparison of Upper and Lower Surfaces of a Composing Frame under Daylight Illumination.

various parts of a composing-frame may vary without causing any inconvenience to the operator—in fact, one is quite unconscious of the variation, except by instrumental aid.

This interesting phenomenon raises the question of how far the foot-candle value of illumination can be taken as a criterion of the "visual value." It is, of course, quite well known that the "visual value" of the illumination of any particular object is largely dependent on the comparative brightness of the adjacent surfaces; and where sharp differences occur, the "visual value" of the lower illumination is depreciated. It is therefore insufficient to specify a certain minimum illumination as necessary, unless it is qualified in some way to prevent the occurrence of sharp contrasts. Although some of the illumination curves given in the paper show marked inflections, the grading was such as to prevent apparent contrast, and work could be satisfactorily carried out on any part of the frame.

On looking round various works, one is often struck by the high illumination values found, and one feels inclined to reflect on the huge amount of light that must sometimes be wasted. Figs. 6 and 7 show a number of curves illustrating the illumination on

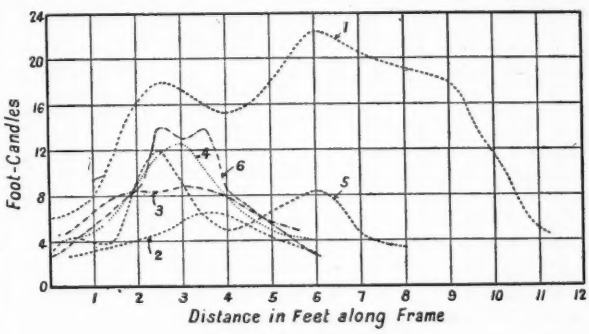


Fig. 6.—Lower Surfaces.

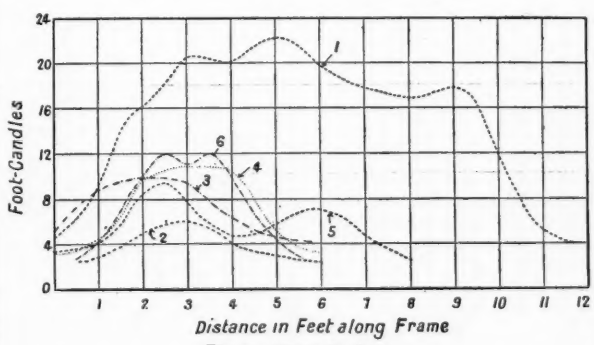


Fig. 7.—Upper Surface.

Illumination of Composing Frames in Various Printing Works.

1. Regent Street Polytechnic.
2. Eyre & Spottiswoode.
3. Mathieson & Son.
4. Solicitors' Law Stationery Society.
5. Cassell & Co.
6. Bradbury, Agnew & Co.

various parts of the working surface of composing-frames. In no case was it felt that the illumination was too low; but it is possible that where the value rises above (say) 8 foot-candles, it might be reduced without impairing the "visual value" of the lighting.

The compositor generally places his galley of type at the extreme end of the composing-frame. Composing frames are usually arranged on one of two systems—viz., either the single or the back-to-back systems; the latter being the most common, because of its effecting economy in light and floor space. The two systems

TABLE I.—*Observations in Various Composing Rooms.*

Description of Works.	Floor Area.	Fitting Used.		Gas Consumption.		Illumination on Working Surfaces.			Length of Frame.
	Square Feet.	No.	Description.	Total Cub. Ft. per Hour.	Per Foot Length of Frame.	Upper Surface.	Lower Surface.	Average.	Feet.
					Cub. Ft. per Hour.				
Polytechnic Printing School	..	3	"Nico" burners	10·5	0·91	14·2	14·8	14·5	11½
	..	2	,, ,,	7·0	0·56	8·5	10·3	9·4	12½
Messrs. Bradbury Agnew	..	1	H.P. Inverted	2·0	0·33	7·1	7·8	7·45	6
Messrs. Cassell's	..	2	H.P. ,,	4·0	0·47	5·6	6·2	5·9	8½
Solicitors' Law Stationery Society	3110	1	H.P. ,,	2·0	0·33	6·8	6·7	6·75	6
Messrs. Eyre and Spottiswoode	1836	1	L.P. Upright	4·0	0·67	3·7	4·5	4·1	6
Messrs. Mathieson and Sons	..	1	,, ,,	4·0	0·67	7·4	7·0	7·2	6

* Calculated on one frame.

TABLE II.—*Observations in Various Machine-Rooms.*

Description of Works.	Floor Area. Sq. Ft.	Type of Fixture.		Gas Consumption.		Machines in Room.		Total Area Occupied by Machines.	Illumination on Working Surfaces.		
		No.	Description.	Total Cub. Ft. per Hour.	Cub. Ft. per Hour per 100 Sq. Ft.	No.	Description.		Max.	Min.	Aver.
Messrs. Eyre and Spottiswoode	2430	5 4	1 lt inverted 3 lt. ,,	60	2·47	2 2 1	Cotterill Miehle Pony	630	6·0	2·2	3·53
,, ,,	2376	8 4	1 lt. ,, 3 lt. ,,	70	2·95	1 2 2 1 1 1	Pony Miehle Hubers Perfector Wharfedale Cotterill	1710	8·4	2·6	3·5
,, ,,	2810	4 5 7	3 lt. ,, 1 lt. ,, 1 lt. upright	88	3·13	3 4 3 1 1	Whitlocks Wharfedales Perfectors Wharfedale Century	—	7·0	2·5	3·3
Solicitors' Law Stationery Society	1800	22	H.P. inverted	50	2·78		Croppers and Wharfedales	—	7·1	4·8	5·8
,, ,,	2880	27	,, ,,	61	2·12		Ruling and Stamping	—	10·5 obscured globe 4·3 clear globe 16·0 on key board 9·0		7·1 14·0
Messrs. Cassell's	—	—	,, ,,	—	—	12	Linotype	—	5·3 on MSS. plate 4·4		4·8
,,	—	—	,, ,,	—	—		Various	—	4·5 4·0	4·5 2·8	4·5 3·4

TABLE III.—*Observations in General Rooms—Packing, Folding, and Binding.*

Description of Works.	Floor Area.	Fitting Used.		Gas Used.	Gas Used.	Illumination on Work Benches.			
		No.	Description.	Cub. Ft. per Hour.	Cub. Ft. per Hour per 100 Sq. Ft	Max.	Min.	Average.	
Messrs. Bradbury Agnew									
Solicitors' Law Stationery Society	1800	28	H.P. Inverted	63	3·5	6·2	3·0	5·0	
Messrs. Eyre and Spottiswoode*	3550	26	L.P. Upright	84	2·37	2·6	2·4	2·5	On benches
,, ,,						3·5	2·8	3·1	On table of cutting-machine
,,	825	14	,, ,,	56	6·78	4·8	3·3	4·1	On benches

* The figures given for this room do not represent the efficiency for the whole of the floor area, because a considerable portion was occupied by material and only slightly illuminated.

A.

Works.	Arrangement.	Gas per Hour per Sq. Ft. of Frame.	Illumination.			
			Max.	Min.	Aver.	Max. Ratio. Min.
		Cub. Ft.				
Messrs. Eyre and Spottiswoode	Back to Back	·134	6·6	2·5	4·1	2·64
Messrs. Mathieson and Sons	Single	·267	10·0	4·6	7·22	2·17

B.

Works.	Gas per Hour per Sq. Ft. of Frame.	Illumination.			Diversity Co-efficiency.	Lumen Hours on Working Surface per Cub. Ft. Gas.
		Max.	Min.	Average.		
Eyre and Spottiswoode's low-pressure upright	·134	6·6	2·5	4·10	2·64	30·7
Bradbury Agnew's high-pressure inverted	·067	12·0	2·9	7·45	4·14	112·0
Cassell's high-pressure inverted	·094	12·0	3·7	5·90	3·25	62·7
Solicitors' Law Stationery Society's high-pressure inverted	·067	12·6	3·3	6·75	3·82	101·0
Mathieson and Sons low-pressure upright	·267	10·0	4·6	7·22	2·17	27·0

are illustrated in figs. 1, 2, 7, and 8. As will be seen, the back-to-back system admits of two frames being illuminated by one source of light. On the other hand, the single system requires one light source for each frame (unless a general scheme is adopted) and a higher consumption of energy per square foot, although the distribution of illumination over the working surface is rather better than with the back-to-back system.

Comparing the illumination of the frames at Messrs. Eyre and Spottiswoode's works with that found at Messrs. Mathieson and Sons, in each case the lighting was by upright incandescent burners, and the shades of approximately the same shape. The gas consumption was found to be twice as great with the single as with the back-to-back frames; and the resultant illumination was higher in a similar proportion, so that the practical efficiency was approxi-

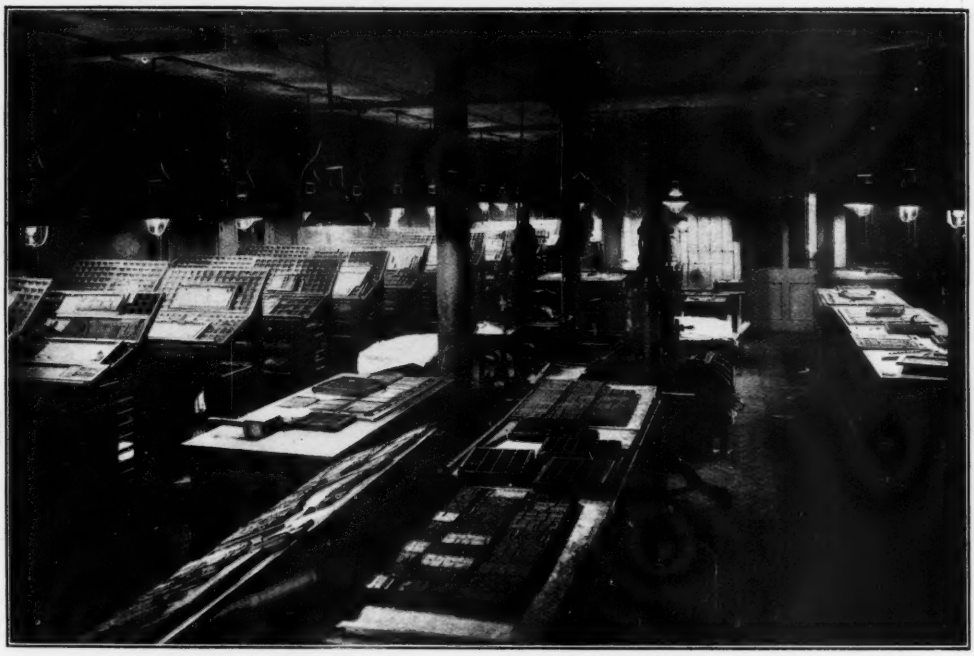


Fig. 8.—Illumination of Composing Frames Arranged in Single Rows.

mately the same in each case. The higher illumination was also accompanied by a lower diversity coefficient; but the difference is of no practical importance. Judged from a practical standpoint, both systems would probably be regarded as satisfactory.

Both high and low-pressure systems of lighting are in use in printing-works installations, and it may be interesting to compare a few installations. It appear that the high-pressure inverted system is about three times as efficient as the low-pressure upright—a result that might, of course, have been anticipated from known data. Against this must be set the cost of compression and a slightly higher cost of maintenance. But these do not seriously discount the economy of the high-pressure system. The efficiency at Cassell's was rather low compared with that found on the other high-pressure installations. This was partly due to the gas consumption per unit length of frame being rather high, as shown in the following summary:—

Works.	Gas Used for Each Frame. Cub. Ft. per Hour.	Length of Frame.
Cassell's	4	8½
Bradbury Agnew's and Solicitors' Law Stationery Society	2	6

The amount of light over each frame at Cassell's was sufficient to adequately illuminate a frame about 12 feet long; so that much of the light was lost, as far as the frame itself was concerned.

The illumination curves obtained at the Printing School of the Regent Street Polytechnic form an excellent illustration of the need for some attempt at standardization of illumination values.

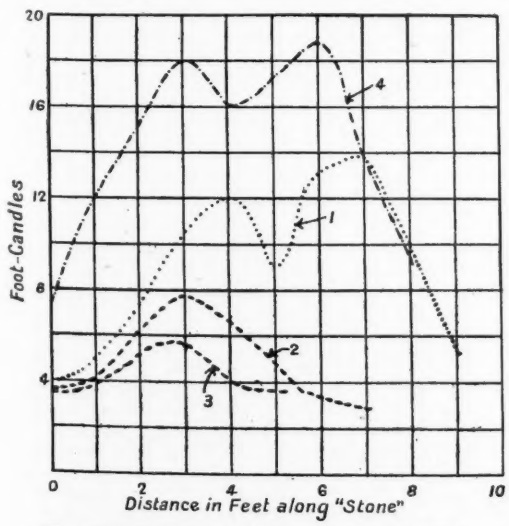


Fig. 9.—Illumination of "Stones" in Various Works.

1. Cassell's.
2. Mathieson's.
3. Mathieson's
4. Eyre and Spottiswoode's.

It appears that, owing to the low cost of production of light by modern methods, there is a great tendency to over-illuminate, although this too frequently results in some reduction of "seeing power."

Illumination of Stones.

What are technically called "stones" are flat faces situated near the composing-frames. The "set-up" type is placed upon the "stones" before being dispatched to the machine. As in the case of composing-frames, a variety of results have been found. Fig. 9 shows the kind of illumination found in a few gas-lighted installations, all of which might be described as satisfactory from a practical point of view, although there can be very little doubt that some of the maxima could be reduced without affecting the "visual value" of the general illumination. It is probably more important that the illumination of the "stones" should be well done than is the case with the composing-frames, because in the latter instance the work is largely of a mechanical nature. Owing to the type being arranged in a definite and well-known order, a compositor can find the letter he wants without looking for it. On the other hand, the final correction of the set-up type is done on the "stones." This undoubtedly requires high visual effort; and therefore good illumination is necessary.

Works.	Area of "Stone." Sq. Ft.	Illumination. Foot-Candles.		
		Max.	Min.	Average.
Messrs. Cassell and Co.	33·0	14·0	4·0	8·4
,, Mathieson and Sons . . .	10·8	7·7	2·8	4·65
,, ,, ,, . . .	16·9	5·6	3·4	4·2
,, Bradbury Agnew	24·5	10·0	8·0	9·3
,, Eyre and Spottiswoode . .	26·8	19·0	7·3	14·2

Brightness of Walls.

This quantity, no doubt, has some influence on the effectiveness or visual value of a given scheme of lighting. Some observations were made in various works; and the results are tabulated in the following summary:—

Works.	Room.	Surface Brightness of Wall (Taken Within 6 Ft. Above the Floor unless Otherwise Stated).	Description of Wall.
		Ft.-Candles.	
Solicitors' Law Stationery Society.	Litho.	3·7 to 5·1	Clean whitewash
,, ,, ,, ,, .	Stamping	3·4 to 4·8	,,
,, ,, ,, ,, .	Composing	3·8(daylight)	,,
Messrs. Mathieson and Sons . .	,,	1·4 to 2·4 0·14 to 0·2 nr. ceiling	Fairly clean
Messrs. Eyre and Spottiswoode .	Machine	0·8 to 1·0 0·44 to 0·74 (ceiling)	Dirty whitewash
,, ,, ,, . . .	Composing	0·48 to 3·0	Clean ,,

The figures refer to gas lighting unless otherwise stated.

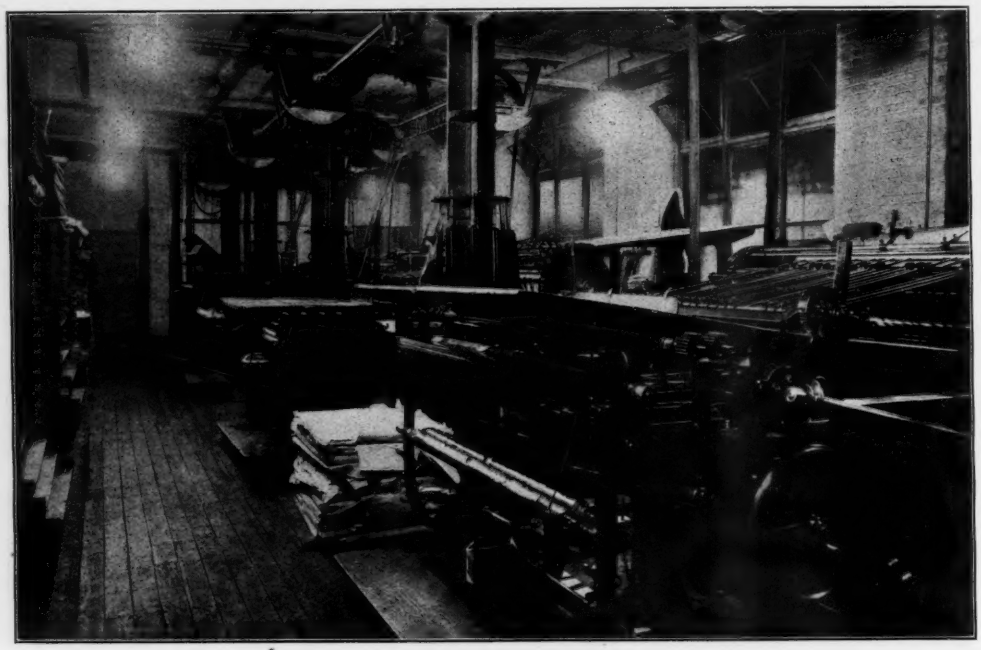


Fig. 10.—Illumination of Printing Machines at Eyre and Spottiswoode's.

Should any proposals ever be made for standardizing the artificial lighting of workshops—*i.e.*, by prescribing desirable maxima and minima—the question of the colour and cleanliness of the surfaces which bound the workshop would have to be taken into account. The difference between clean and dirty whitewashed walls is very considerable. This introduces a difficult factor. In any specification for street lighting, the surfaces of buildings in the street is rather a troublesome matter to take into account.

Reading-Rooms.

Generally speaking, the values found in the reading-rooms were rather high, due to the fact that the surfaces to be illuminated were comparatively small; so that, with even a small unit of light, a sufficiency of illumination was easily secured.

The following summary gives some of the data obtained :—

Reading-Rooms.

Works.	Illumination Foot-Candles.			System of Lighting.
	Max.	Min.	Aver.	
Messrs. Cassell and Co.	13·0	5·0	8·2	High-pressure inverted
Messrs. Eyre and Spottiswoode .	15·0	8·0	10·0	Lower pressure upright
Messrs. Bradbury Agnew . . .	15·0	8·4	10·5	High pressure inverted

Machine-Rooms.

A summary of the results obtained in several machine-rooms is given in the appendix.

It would appear that the following are the principal points that require consideration:

(1) The "laying-on" and "taking-off" boards of the machines need to be adequately illuminated.

(2) A good general illumination is needed to facilitate the transfer of the printed sheets to the benches for purposes of inspection.

(3) Means for illuminating the under-parts of the machinery for inspection purposes should be prescribed.

The working surfaces referred to in the summary of machine-rooms are, in the case of printing-machines, assumed to be the "laying-on" and "taking-off" boards. The arrangement of the units in the machine-shops of Messrs. Eyre and Spottiswoode (shown in figs. 10 and 11) appears to be very satisfactory. The illumination is due to three-mantle and one-mantle inverted units fitted with diffusing globes. The arrangement is clearly shown in the photographs, and the photometric data are given in the table relating to machine-rooms. The machines at this works are of large type, for which the scheme of lighting seems to be very well suited.

It may be interesting to mention here that it is sometimes necessary to provide against the vibration set up by the moving machinery; otherwise an excessive mortality of mantles would result.

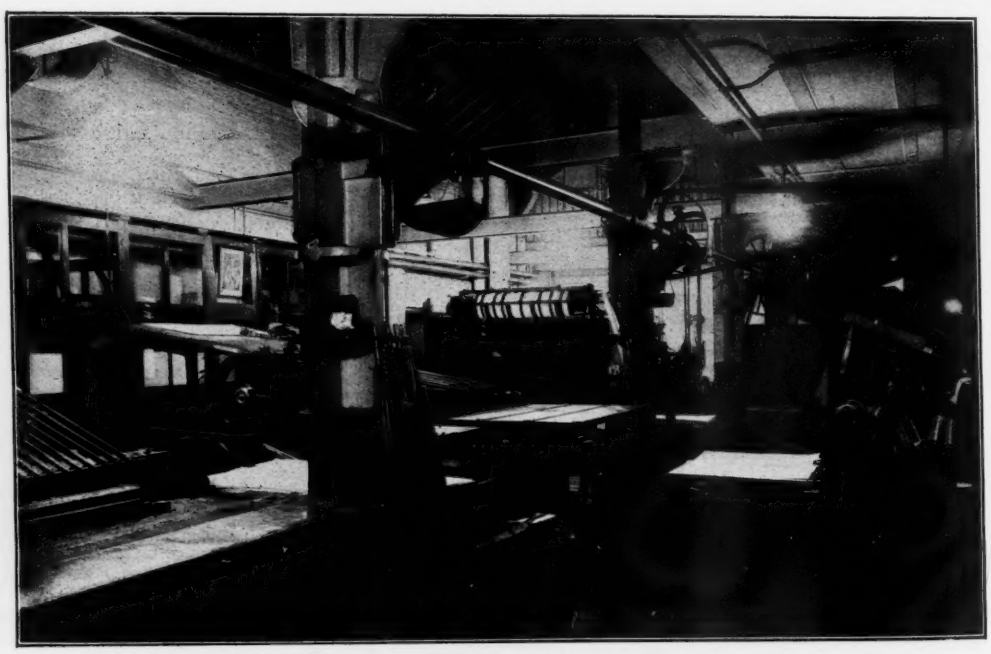


Fig. 11.—Illumination of Printing Machines at Eyre and Spottiswoode's.

Fig. 12.—Illumination of Ruling Machines at the Solicitors' Law Stationery Society.

Efficient appliances are available which prevent damage due to vibration; and, as far as I know, there is no difficulty arising from this cause which cannot be effectually provided for.

Fig. 10 is a particularly good specimen; but in this case the arrangement of the machines simplifies matters somewhat—a condition that does not always exist.

A feature in the lighting of large printing-machines is the provision of special units for facilitating the inspection and repair of the hidden parts of the machine—*i.e.*, the parts that receive no light from the general illumination. This can be easily and satisfactorily provided for by flat-flame burners arranged on double-jointed arm brackets. By this means the flame may be brought to the point of the machine to be examined; and a local illumination of anything up to 7 foot-candles obtained. The device works very satisfactorily in practice. It is not necessary that the flame should burn continuously. It is usually extinguished when the machine is working. The double-jointed arm gives a flexibility of movement which permits of high local illumination at any part of the interior of the machine. It is often necessary to inspect the type, which is contained in a frame inside the machine; and the flat-flame burner answers very well for this purpose. It gives sufficient light, will stand rough usage, and cannot very well go

Fig. 13.—Illumination of Linotype Machines.

Fig. 14.—Illumination of the Litho. Room at the Solicitors' Law Stationery Society.

wrong. Another device is to have a flat-flame burner arranged on a pillar, to which gas is led through a flexible tube.

Various other machine-rooms were visited in the course of the preparation of this paper. Fig. 12 shows the distribution of light over the working surfaces of the two ruling-machines. The machines were contained in a basement room having an area of 1800 square feet.

Fig. 13 shows a fairly large installation of Linotype machines. Their arrangement is very regular; and thus permits of an ordered system of illumination—a condition of things that is, unfortunately, not always possible. Each machine is separately provided for, so that the lighting is always proportional to the output—an important matter from an economical point of view. The units at the front of the machines are arranged a little in the rear and towards the left-hand side of the operator, and 7 feet above the floor. The resultant illumination seems adequate in amount and satisfactory in character. There are twelve machines, arranged in two rows of six, back to back, with a gangway between, so that easy access is gained to every part. Special units along the gangway facilitate inspection and repair when necessary.

It is interesting to note in passing that gas is used for melting the metal in these machines. A great deal of gas at high pressure is supplied for this purpose; and so the high-pressure system is found to be of double utility and economy.

LITHO.-ROOM.

Some observations made on the stone lithograph blocks at the works of the Solicitors' Law Stationery Society showed values ranging between 6·2 to 10 foot-candles. Fig. 14 shows such a room.

In conclusion, I would like to acknowledge the kind assistance rendered by those in charge at the various works visited, without which it would have been quite impossible to compile the information in the foregoing all too inadequate contribution to the discussion of this important subject, and also my indebtedness to my assistant, Mr. J. G. Clark, who has prepared for me all the data on which this paper is founded.

Points in Mr. Justus Eck's Paper.

In this paper the electric lighting of printing-works was dealt with—the author treating of arc lamps, inverted and indirect lighting; glow lamps, direct and indirect lighting, both carbon and metal filament; vapour lamps, in glass and quartz tubes. He dealt principally with newspaper printing works, feeling that in these places—where the work is mostly done at night, and where time is the very essence of the business—every effort would be made to secure maximum output of printed matter with the least running cost. Other important factors, he said, have to be considered in this work—such as safety both to the person and against fire, absence of heat, non-contamination of the air, freedom from glare, ease of supervision of machines and operatives, correctness of colour discrimination, and entire absence of eye-strain. These factors undoubtedly have weight; but in many cases other factors have militated against proper consideration being given to them. These other factors seem to include such things as difficulties with the operatives; unsuitable shape and sizes of the workrooms, due to the high value of sites in London; and lack of information as to the methods adopted and the results obtained in other printing works. All the engineers, managers, and other officials the author had met seemed to consider maximum output of product and safety against fire as the considerations of the greatest importance. Inquiry as to data to establish what the increase of output resulting from the improved lighting conditions had been, resulted chiefly in the reply that, without their present form of lighting, they could not produce as rapidly and cheaply as now, and that it was inconceivable to turn to any other form of illuminant. The reason of this want of positive information is that, contemporaneously with, or subsequently to, the introduction of electric light, alterations or improvements in the plant have taken place. The sole place where real comparisons were possible was in the hand-composing room, and here the increased illumination without glare or perceptible increase in the temperature had not only resulted in more rapid output, but also in improvement in the eyesight of the compositors.

The author then dealt extensively with the lighting of various parts of printing-works by the various systems of electric lighting. He emphasized the importance of the use of proper reflectors, shades, and so forth; and the exercise of discrimination as to the type of lamps to be used in the various apartments. In most of the works he had visited, there was room for improvement in the illumination. Especially emphatic was he that where work has to be carried out by night, the strain of direct lighting from either large or small units becomes serious; and, without doubt, the nearer the spectrum of the light resulting from the sources used approaches that of daylight the less fatiguing is the work—many operatives working with an ample supply of indirect approximately white lighting having found their eyesight improve to such an extent as to enable them to discard their spectacles.

Discussion.

The CHAIRMAN described the papers as excellent ones. Coming together as they did, they had before them the independent results of two sets of investigations.

Mr. FRANK BAILEY spoke of the beneficial effect of improved lighting in works of the kind described. Not only was there improvement in the work done, but there was greater facility and comfort for the workpeople. He asked whether there was any information available as to the effect of the mercury vapour lamp upon the eyesight. They heard of injury to the eyes through the metallic filament lamp; and he should like to know from Mr. Justus Eck whether any case had been brought to his notice of any deleterious effect through such illumination.

Mr. WILLCOX thought the illustrations that had been given of the lighting of printing-works (presumably he was referring to both gas and electricity) showed the need—and the simple need—existing of a change in the position of the lamps used, as well as the proper equipment of the lamps. Another requirement was a knowledge of what constituted a good reflector. A great advance had been made in the design of reflectors that gave them the light just in the direction required; and this was a matter that needed pushing home. He showed that he did not think much of the conical form of reflector. Congratulations fell from him to Mr. Eck on the success attained by indirect electric lighting. At the same time, Mr. Eck would pardon him saying that most of the same results could be practically obtained with glow lamps.

Mr. WALDRAM considered that, in artificial lighting, the more one could approach daylight with regard to the spectrum and the way the light reached the eye, the better. One might therefore expect that indirect lighting would give by far the best results in the long-run.

Mr. RITCHIE remarked that Mr. Goodenough had emphasized

particularly the value of a sufficient volume of light for night purposes; but in his examples he had apparently shown cases where very little night work, so far as he knew, was habitually done. Most of the gas examples were of places where the bulk of the work was done in the daytime; and therefore where the artificial lighting was not of the importance that it was in the newspaper world for instance, where practically the whole of the work was of necessity carried out through the night. In no way did Mr. Goodenough refer to the condition of the atmosphere, or to the increase in the temperature which was brought about particularly by the use of the flat-flame burners which he advocated for the examination of the interior of machines. There was a point in this connection which he (Mr. Ritchie) had met more than once. It was that the rollers of the large rotary presses were extremely fastidious in their needs; and a comparatively small increase of temperature—an increase which was well within the limits occurring in a building running throughout the night—was sufficient, and had been sufficient in many cases, to affect the rollers to such an extent as to bring the machine to a standstill. Another point was that increased temperature affected the "register" especially in lithographic and colour printing. He was told that this variation had been found to be as much as 1·32nd of an inch on a 40-inch paper in a room lighted by gas, and run from 8 a.m. to 8 p.m. He spoke of the difficulty of using reflectors for indirect lighting in places where high-speed printing-machines were running, on account of the deposit that accumulated on them.

Mr. FOULDS spoke of the effect of artificial lights on the eyesight being due more to glare than to the quality of the light. He (like Mr. Ritchie) also had a tilt at the use of gas; remarking that where gas lighting was used there electricity had also to be employed for running fans to cool the premises.

Mr. MASCORD spoke of the conversion from gas to electric lighting of the printing establishment with which he is connected. But he admitted that he had noticed the great improvement in gas lighting; and said that had gas companies been as awake as they are now at the time to which he referred, there was no doubt whatever the electric light would not have made the progress it had so far done. Had he to start lighting again to-day, he did not know whether he should put in gas or electric light. He proceeded to give an account of the electric lighting in the building with which he is associated. He agreed that, within limits, the more light one could get, the better it was for workpeople.

Mr. MACKINNEY said the old fishtail gas-burner could not be put aside as it had been by some speakers. He had visited a cotton-mill, where the old fishtail burners had been removed and high lights had been put in position; and the result was the light was not got where it was wanted. They could not place a light of many hundred more times intrinsic brilliancy than a fishtail burner where they could place the latter.

Mr. CAMPBELL also spoke of the haphazard situation of lights found in factories; and of the wastefulness of a want of systematic treatment.

Mr. GASTER said that it might interest the members to know that Dr. L. Carozzi, of the hospital for the study of industrial diseases in Milan, was making a very exhaustive inquiry into the question of the effect of different illuminants in printing works. He was going very thoroughly into the matter of ventilation; and, after what transpired at the Brussels Congress, there was going to be a very thorough investigation, with the view to legislation in the future.

The CHAIRMAN remarked that though he was an electrical engineer, his opinion was that the inverted gas-lamp required a lot of beating, when they came to the lighting of things like compositors' frames where the illumination had to be high, and the light thrown on to a nearly black surface. When the members had time to study Mr. Goodenough's figures, they would find they were very high indeed; and though there were cases where they could get too much light, there was not a single case where they could have too much light on a black surface. Therefore, the high illumination they saw in Mr. Goodenough's tables must be greatly appreciated.

Mr. GOODENOUGH remarked, at that late hour of the evening, further discussion was really quite impossible, He only wished to say to Mr. Ritchie—not as a gas engineer, or as the writer of one of the papers, but as Chairman of the Council of the Society—that it had been an honourable tradition of the Society to exclude from their discussions controversial matters between illuminants. He (the Chairman) thought he might "congratulate" Mr. Ritchie upon being the first member of the Society to break the tradition, which he (the Chairman) had endeavoured to observe, and which he had no intention of departing from that evening.

A vote of thanks to the authors concluded the proceedings.

The Hughes prize has been awarded by the Paris Academy of Sciences to M. Féry, whose name is well known in connection with his optical pyrometer and other instruments for the measurement of high temperatures.

At the Students' Meeting of the Institution of Civil Engineers held on the 15th inst., a paper was read by Mr. A. E. Gladwyn on "The Heat Value of Fuels." The author dealt with the importance of making all possible economies in the use of fuels, and discussed fully the relative merits of the different types of calorimeters now used to determine the heat values of various materials. The paper was illustrated by lantern-slides showing the interior arrangements of the calorimeters mentioned.

THE USE OF GAS FOR CUTTING METALS.

[COMMUNICATED.]

SOME time ago, the writer had occasion to convert an old Cornish boiler into a feed-water tank; and to do this it was necessary to cut out the furnace tube. The boiler maker, on being asked to quote a price for doing the job, would not undertake it under £25. This was considered a high figure; and, consequently, an outside firm who make a speciality of such work were invited to submit an estimate. On inspecting the job, they said it would cost £5 or £6—volunteering the information that so low a price was only made possible by using an oxy-acetylene blow-pipe. The tube was cut in eight pieces, and withdrawn without the necessity of taking off an end plate. The whole job was completed at a cost of £6 12s., of which £2 18s. 6d. was for labour, £2 11s. for oxygen, 7s. 6d. for acetylene, and the rest for cartage.

The writer was so much impressed with the possibilities of the blow-pipe, that he inquired as to the relative efficiency of ordinary gas for the cutting of metals as compared with acetylene. He found that some makers reserve all the praise for the acetylene blow-pipe, which is far from fair to town gas, as excellent results can be obtained with the latter at low cost and without the unnecessary expenditure of money on acetylene generating plant. It is only reasonable to suppose that the maker would prefer to sell an acetylene generator and blow-pipe in preference to a blow-pipe only, which is all that is required where gas is used. The blow-pipe and automatic regulator—the latter being required for adjusting the flow of oxygen—appear to be rather expensive, costing about £10. This, however, is small compared to the amount of money which it is possible to save in twelve months. As an instance, a blow-pipe used by an entirely inexperienced man, with ordinary gas and oxygen, cut a boiler furnace tube into two pieces in 43 minutes. The length cut was 27 feet, of ⅜-inch plate. There was consumed 31·7 cubic feet of oxygen, costing 5½d., and 18·6 cubic feet of gas. So that the cost of doing the job was not more than 1s. in all. To cut through an exactly similar tube with hammer and chisel before the blow-pipe was procured, occupied a plater and mate 1¼ days, costing about 13s.

All engineers must at some time have been impressed with the difficulty and expense of cutting through large joists, bars, plates, and rolled sections of all shapes in places where power-driven saws cannot be used. Recourse must be had to cutting through such materials with hammer and chisel, hacksaw, or drilling tackle. Whichever method is used, the expense and time taken to do the job are very unsatisfactory. On one occasion, the writer found it necessary to cut through a heavy retort-setting buckstay in position. This was drilled off by hand at a cost of 21s. But fourteen exactly similar sections were later cut off by an acetylene blow-pipe at a total cost of 33s. This included profit to the firm who undertook the job, and cartage of the acetylene generator, oxygen, &c. Since that time the writer has had a similar buckstay cut off with an oxy-coal gas blow-pipe in twelve minutes, which shows that, for all practical purposes, ordinary gas is as good as acetylene gas.

It is a very great advantage that such jobs can be carried out quite easily wherever gas is laid, as nothing but an oxygen cylinder 4 ft. long by 9 in. diameter, two lengths of hose pipe, and the blow-pipe are required. The latter can be mounted on suitable framework so as to cut the material into any exact shape, such as by using compasses to cut circular plates. Perfectly straight lines may be cut with equal facility.

The wonderful results that can be obtained by oxygen in the cutting of metals recall the well-known experiment of putting fine iron dust into a bottle containing oxygen, with the result that the dust instantaneously emits a bright light and is immediately consumed. As a matter of fact, it would be expected that when once iron has been ignited in the presence of oxygen it would be burnt away without the assistance of any auxiliary such as fuel gas, provided that a powerful jet of oxygen is concentrated on the metal. That this is impossible is due to the fact that oxide of iron is formed, preventing the intimate contact of the metal and gas, with the result that the combustion of the metal is arrested. Some additional source of heat, such as is provided by the gas used, is required to maintain the oxide of iron in a sufficiently molten state to cause it to flow away from the iron as soon as it is formed.

It is not only in metal cutting that the blow-pipe is useful to the engineer. For welding purposes it is being much employed, more especially in awkward places where the parts to be welded cannot be brought to the smith's fire. The system is particularly applicable to the repairing of boiler furnace tubes. Instead of patching defective parts, they may be cut out by the blow-pipe and a new piece welded into the place. A great deal of very useful work has been done in this direction by firms who make a speciality of sending out skilled men to undertake welding work of this description. So far, not much is heard of the oxy-coal gas blow-pipe for this work; but there is no doubt that, when the process becomes more widely known by engineers with no interest in making and selling acetylene generating plants, much progress will then be made by using ordinary gas in place of acetylene.

In the meantime, it behoves gas engineers to make themselves acquainted with the possibilities of gas for work of this description. We shall then see developments which will render the use of gas essential in the repairing shops of all engineering firms.

STUDIES IN CARBONIZING.

II.—DISTILLATION IN HORIZONTAL AND INTERMITTENT VERTICAL RETORTS.

By Dr. W. B. Davidson, of Birmingham.

As already stated—see "Journal" for March 5, p. 664—the main purpose served by the following tables—which contain figures indicating quantity, quality, and composition of the gas taken off at different stages in the course of distillation—is to aid the student in forming an opinion as to the cause operating under the various conditions specified.

The total gas production, however, cannot be readily or accurately determined by charging all the retorts at the same hour, and carrying on the distillation for a certain number of hours. This uncertainty is due to the rapid variation in the volume and quality of the gas evolved from hour to hour, and to the practical difficulty in regulating the pressures in the retorts so as to avoid loss of gas, and at the same time prevent the admission of waste gases. Especially is this the case in carbonizing light charges, from which the gas comes off with extreme rapidity during the first hour or two.

It is much safer to rely on the ordinary method of testing on a practical scale with large quantities of coal for information as to the relative merits of different methods or systems of carbonizing. Diagrammatic curves serve better than figures to present a general view of the progress of the distillation. The Derbyshire coal here tested contains 1·4 per cent. by weight of nitrogen. Of the nitrogen, 50 per cent. remains in the coke; 20 per cent. forms ammonia, cyanogen, and other nitrogen compounds; leaving 30 per cent. to produce nitrogen in the gaseous state, which would then occupy a volume of about 125 cubic feet in the gas made from a ton of coal. One per cent. of nitrogen may therefore be taken as representing the true proportion of this element in the gaseous mixture—anything over and above this coming directly from the air or from the furnace gases. Hence the necessity of reducing the volumes to a constant content of 1 per cent.

The analytical figures indicate less leakage in the vertical retorts than in the horizontals. The distribution of nitrogen is practically the same with verticals as with horizontals. What the former gain in ammonia they lose in hydrocyanic acid.

Light and Heavy Charges.

The figures here set forth represent the results of distilling charges of coal corresponding to carbonizing periods of six, eight, and twelve hours respectively; the rate of distillation in each case being 1·1 cwt. per retort per hour, and the carbonizing temperature in the retort at the time of charging about 2000° Fahr. The gradation in make per ton, candle power with No. 2 burner ("I.P. No. 2"), and calorific value ("C.V. net") are pretty much the same in each case.

The last 5 per cent. of the gas made has practically no illuminating power, and a calorific value of only 350 B.Th.U. The sulphuretted hydrogen is at first rather high; soon increases to a maximum; and then rapidly diminishes till at the end of the distillation it is only one-fifth of its average volume. Carbon dioxide is at a maximum at the end of the first hour with light charges; after two hours, with heavy charges; and gradually decreases to about one-third of what is represented by the average composition. The considerably lower figures for the 8·67 cwt. charges I attribute to an error on the part of the analyst rather than to any real difference. Unsaturated hydrocarbons (C_nH_m) come off in by far the largest proportions at the outset; the percentage being highest in the case of the light charges. The amount present in the gas at the finish of the normal period of distillation is hardly capable of measurement. The true percentage of oxygen in the gas is somewhat uncertain. It is clear, however, that only a small proportion of the total oxygen present can be derived directly from the air or from the furnace gases; otherwise the figures for nitrogen and oxygen would rise and fall simultaneously. Another conclusion to be drawn is that light charges favour higher production of this element.

The content of carbon monoxide keeps very steady throughout, but tends to rise towards the finish.

Methane starts at a maximum of 46 per cent., and drops steadily to about 9 per cent.; while hydrogen begins at approximately 31 and finishes at the high figure of 77.

In comparing the average composition of the gases, little variation is to be noticed. Taking the figures as they stand, the total yield of heat units would appear to be rather more with twelve-hour work than with six-hour work. In candle power probably the reverse holds, though this is difficult to estimate. For the reasons stated, the figures are not so reliable as those obtained from ordinary coal tests. The statement that heavy charging

TABLE I.

Horizontal Retorts.

Derbyshire Coal.—Charge, 6·5 cwt.; Weight of Coal Used, 3·90 tons.

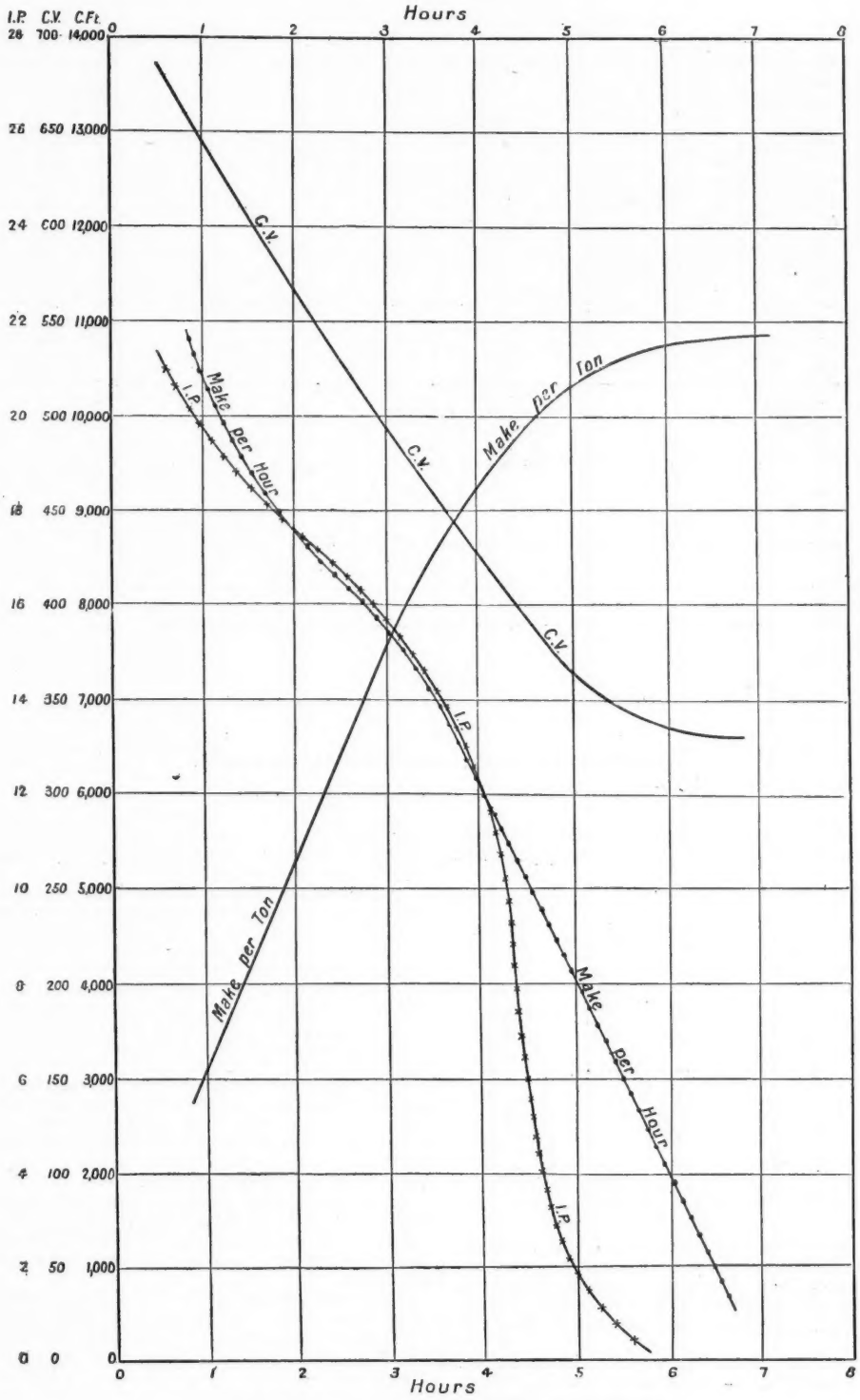
Actual Tests.

No. of Hours after Charging.	Make p r Hour.	Make per Ton per Hour.	Make per Ton.	I.P. No. 2.	C.V. Net.	H_2S.	CO_2.	C_nH_m	O.	CO.	CH_4.	H.	N.
	Cubic Feet.	Cubic Feet.	Cubic Feet.										
½	..	..	..	21·40	651	..	3·34	6·83	0·79	9·24	44·3	29·2	6 4
1	11,200	2900	2,900	19·80	606	1·55	3·22	5·10	0·61	9·34	37·7	38·8	5·2
1½	..	..	..	18·20	605	..	2·93	4·45	0·51	9·20	38·1	40 7	4·3
2	8,800	2300	5,200	17·90	566	2·15	2·81	3·84	0·80	9·90	32·0	45·4	5·0
2½	..	..	..	17·60	527	..	2·43	2·95	1·00	9·55	30·8	49·4	4·2
3	8,700	2200	7,400	16·75	498	1·50	2·32	2·27	0·54	10·19	27·9	51·4	5·3
3½	..	..	..	15·50	468	..	2·03	1·14	0·55	10·04	24·1	58·0	4·3
4	7,300	1900	9,300	12·05	424	1·00	1 61	0·85	0·71	9·74	19·0	64·1	4 3
4½	..	..	..	7·11	383	..	1·08	0·63	0·48	10·13	14·8	69·1	4 2
5	4,600	1200	10,500	2·18	364	0·90	0·95	0·13	0·15	9·88	14·1	66·1	8 8
5½	..	..	..	..	316	..	0·83	0 00	0·70	11·12	10 0	64·6	12·9
6	2,200	600	11,100	..	305	0·80	0·62	0·00	0·53	10 85	9·4	67·4	11·2
6½	..	..	..	..	300	..	0·76	0·16	0·66	9 32	8·7	69·0	11 6
7	580	100	11,200	..	304	0·40	..	..	..	..	..	..	11 6

Tests Corrected to 1 Per Cent. N.

½	..	..	..		686	..	3·53	7·22	0·84	9·73	46·8	30·9	1·0
1	10,700	2700	2700	..	632	1·61	3·33	5·32	0·85	9·72	39·4	40·4	1·0
1½	..	..	..		625	..	3·01	4·57	0·53	9·51	39·4	42·0	1·0
2	8500	2200	4900	..	589	2·23	2·92	4·00	0·85	10·33	33·4	47·5	1·0
2½	..	..	..		544	..	2·51	3·03	1·03	9·83	31·7	50·9	1·0
3	8400	2100	7000	..	521	1·56	2·43	2·37	0·56	10·65	29·2	53·8	1·0
3½	..	..	..		483	..	2·09	1·18	0·57	10·37	24·9	59·9	1·0
4	7000	1800	8800	..	438	1·03	1·65	0·88	0·73	10·04	19·6	66·1	1·0
4½	..	..	..		393	..	1·11	0·65	0·50	10·45	15·2	71·1	1·0
5	4400	1100	9900	..	392	0·37	1·02	0·14	0·16	10·68	15·7	71·3	1·0
5½	..	..	..		353	..	0·94	0·00	0·79	12·45	11·9	72·9	1·0
6	2000	500	10,400	..	337	0·88	0·68	0·00	0·56	11·97	10·9	74·9	1·0
6½	..	..	..		332	..	0·82	0·18	0·71	10·30	10·1	76·9	1·0
7	540	90	10,490	..	336	0·44	..	..	..	..	..	..	1·0
Average 6 hours			10,400	..	555	1·53	2·39	3·30	0·70	10·12	31·3	51·2	1·0

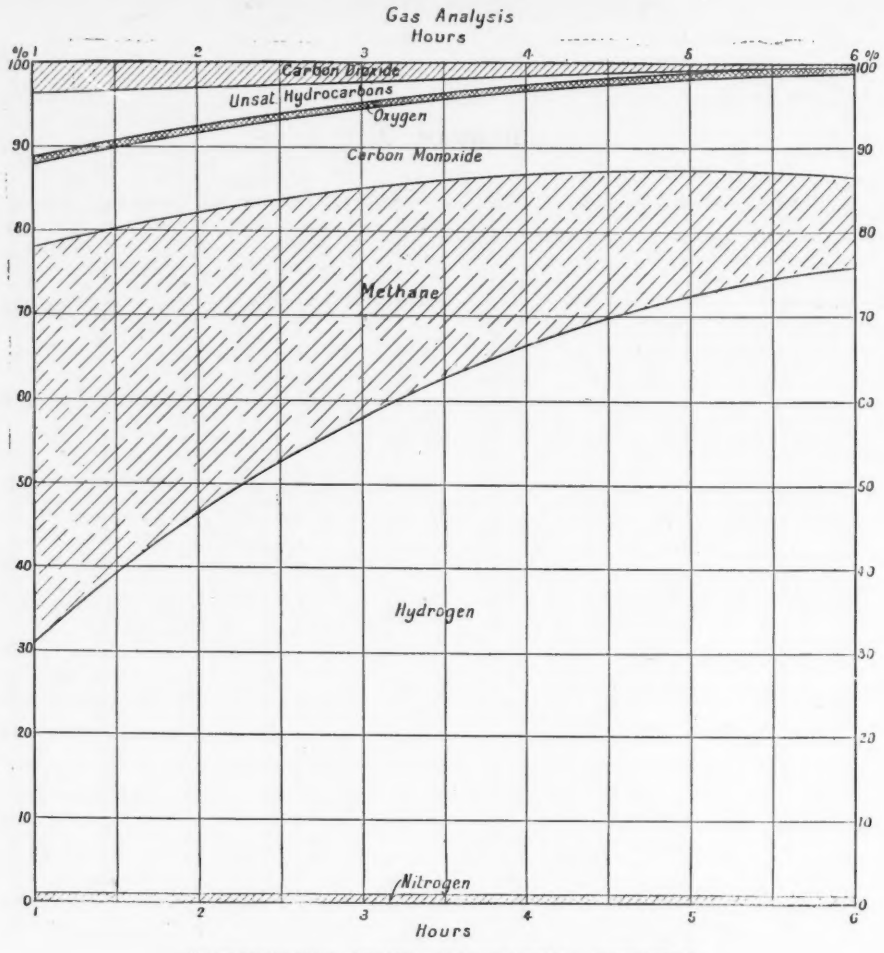
DIAGRAM A.



CARBONIZING TEST.—HORIZONTAL RETORTS.

CONDITIONS—CHARGE 6·5 CWT. LEVEL GAUGE. NO SEAL.

DIAGRAM (a).



CARBONIZING TEST.—HORIZONTAL RETORTS.

CONDITIONS—CHARGE, 6·5 CWT. LEVEL GAUGE. NO SEAL.

produces, on the whole, less gas of standard quality than light charging is based on the following observations already published.

Horizontal Retorts.

Observer.	Series.	Charge.	Duration.	I.P. Multiple.	C.V. Multiple.
		Cwt.	Hours.		
J. Ferguson Bell	1	6·00	6	172·7	572
1909		8·00	8	175·3	585
1910		10·00	10	167·1	562
		12·00	12	169·3	556
,,	2	8·00	8	192·5	[?]
		12·00	12	188·1	[?]
Davidson and					
Pearson	1	6·49	6	183·2	641
1911		8·76	8	181·7	598
		13·41	12	171·2	592
,,	2	8·10	8	186·2	648
		12·21	12	178·6	597
,,	3	6·41	6	197·3	648
		9·72	9	194·0	631

Table IV. is of special interest, as it enables us to study the consecutive stages of distillation of coal that has been first disintegrated and then moistened with an admixture of 12½ per cent. of water, as in coke-oven practice, for the manufacture of blast-furnace coke. Comparing the figures with those of the last table we find—

1. The evolution of gas for the first 11 hours is remarkably constant; while the quality is also comparatively steady.

2. The distillation period is considerably lengthened; being equal to 14½ hours as against 12 hours for an equal yield of gas from dry coal, or 16 hours for what might be regarded as complete distillation. [I understand that in coke-oven practice the distillation period is 30 per cent. longer for wet, stamped coal than it is for dry coal; but as the charges are about 20 per cent. heavier, the capacity of the carbonizing plant is reduced probably by only 10 per cent.]

3. The illuminating power and calorific value are relatively low; but the total yield is high. There is a considerable reduction in the illuminating power multiple (due largely to excessive CO_2 content), but no appreciable difference in total heat units.

4. Sulphuretted hydrogen and carbon dioxide are increased nearly 50 per cent. The evolution of larger quantities of the former has the effect of leaving less sulphur in the coke. The removal of the latter—partially or completely—is desirable, if high candle power is to be maintained.

5. The carbon monoxide and hydrogen percentages agree closely with those found in the gas produced from dry coal.

When we come to study the process of distillation in vertical retorts of the Dessau system, we find some striking differences. Here the comparison should be made with the carbonization of 13 cwt. charges of 12 hours' duration in horizontal retorts. While the evolution of gas proceeds at practically the same rate in both cases (the disparity in the first hour is probably more apparent than real, owing to the much longer time required to hand-charge the horizontal retorts), both candle power and calorific value are distinctly higher at the outset and fall away less rapidly in the case of "horizontals." And although the yield of gas per ton of coal is greater from verticals than from horizontals, both illuminating power and calorific value multiples are decidedly less in the former case whether 10 hours or 12 hours be taken as the period of distillation.

The following table gives the figures for ordinary distillation up to ten hours followed by steaming. To allow the yield, calorific value, and composition to be calculated for the full period of 12 hours, the test was carried out under similar conditions but without steam.

The retort temperature was in this case rather low, and the yield of gas small. The quantitative analytical results are therefore not set out in detail. Diagrams indicate the course the prolonged distillation takes. There is a similar gradation in the percentage content of the different ingredients of the gaseous mixtures sampled from hour to hour; but the gas obtained from the vertical retorts has an average composition differing in some important respects from that produced by the horizontal retort working.

The figures placed side by side are as follows:—

	Make.	C.V.	CO_2.	C_nH_m.	O.	CO.	CH_4.	H.	N.
Horizontals . .	10,440	540	2·50	3·25	0·40	10·28	30·8	51·8	1·0
Verticals. Ten hours . . .	10,650	500	2·25	2·63	0·43	11 00	27·5	55·2	1·0
Verticals. Twelve hours . . .	10,900	496	2·20	2·58	0·43	11·1	27·1	55·6	1·0

The deficiency in vertical-retort gas with respect to unsaturated hydrocarbons and methane (the two most important constituents) is very marked. It must be remembered that the candle power

TABLE II.

HORIZONTAL RETORTS.

Derbyshire Coal.—Charge, 8·67 cwt.; Weight of Coal Used, 5·4 tons.

ACTUAL TESTS.

No. of Hours after Charging.	Make per Hour.	Make per Ton per Hour.	Make per Ton.	I.P. No. 2.	C.V. Net.	H_2S.	CO_2.	C_nH_m.	O.	CO.	CH_4.	H.	N.
	Cubic Feet.	Cubic Feet.	Cubic Feet.	Candles.									
½	5550	..	..	..	..	..	..	..	..	..	..	..	..
1	5250	2000	2,000	22·25	647	1·95	2·89	6·33	0·26	9·55	40·2	38·4	2·4
1½	5250	..	..	19 80	561	..	..	..	..	..	..	..	..
2	5350	2000	4,000	18·00	549	2·20	2·18	3·79	0·38	9·90	32·0	48·7	3·0
2½	5050	..	..	17·60	529	..	2·17	3·35	0·25	10·21	30·5	48·8	4·7
3	5050	1900	5,900	17·45	541	1·70	2·10	2·42	0·48	10·03	30·2	50·0	4·8
3½	4850	..	..	16·55	508	..	1·75	2·16	0·59	10·13	28·6	54·2	2·6
4	4650	1750	7,650	15·35	488	1·20	1·52	1·57	0·81	9·90	27·5	54·5	4·2
4½	4150	..	..	11·10	458	..	1·52	1·43	0·52	9 91	23·0	60·1	3·5
5	3700	1450	9,100	9·60	482	1·30	1·00	0·68	0·64	10·15	18·1	64·2	5·2
5½	3000	..	..	2·70	377	..	0·90	0·44	0·73	10·01	15·9	65·0	7·0
6	2250	1000	10,100	1·56	346	1·00	0·82	0·27	0·26	10·22	13·5	67·4	7·5
6½	1650	..	..	1·04	347	..	0·15(?)	0·00	0·27	11·43	9·9	66·5	10·7
7	1100	500	10,600	..	308	..	0·58	0·00	0·17	10·64	6·9	71·0	10·7
7½	550	..	..	..	307	..	0·32	0·00	0·35	10·33	8·3	69·2	11·5
8	350	150	10,750	..	291	..	0 35	0·00	0·23	10·88	7·3	68·8	12·3
8½	150	..	..	..	..	..	..	..	..	..	..	..	..
9	80	50	10,800	..	..	..	..	..	..	..	..	..	..

TESTS CORRECTED TO 1 PER CENT. N.

½	5450	..	..	..	..	..	..	..	..	..	..	..	..
1	5150	1950	1,950	..	655	1·98	2·93	6·42	0 29	9·68	40·8	38·9	1·0
1½	5100	..	..	..	578	..	..	..	..	..	..	..	..
2	5200	1950	3,900	..	563	2·24	2·24	3·89	0·39	10·17	32·6	49·7	1·0
2½	4900	..	..	..	548	..	2·25	3·47	0·26	10·59	31 7	50·7	1·0
3	4850	1850	5,750	..	562	1·76	2·18	2·51	0·50	10·42	31·4	52·0	1·0
3½	4750	..	..	..	524	..	1·77	2·19	0·60	10·26	29·1	55·1	1·0
4	4500	1700	7,450	..	504	1·24	1·57	1·62	0·84	10·25	28·4	56·3	1 0
4½	4050	.	..	..	469	..	1·56	1·47	0·53	10·14	23·7	61·6	1·0
5	3600	1400	8,850	..	470	1·35	1·04	0·71	0·67	10·55	19·0	67·0	1 0
5½	2800	..	..	..	400	..	0·98	0·49	0·78	10·63	17·0	69·1	1 0
6	2100	900	9,750	..	368	1·06	0·87	0·29	0·28	10·93	14·6	72·0	1·0
6½	1500	..	..	..	381	..	0·16(?)	0·00	0·32	12·70	11·7	74·1	1·0
7	1000	450	10,200	..	338	..	0·68	0·00	0·19	12·40	7·7	76·0	1·0
7½	500	..	..	..	337	..	0·35	0·00	0·38	11·37	9·8	77·1	1·0
8	300	100	10,300	..	320	..	0·39	0·00	0·26	12·15	8·8	77·4	1·0
8½	100	..	..	..	..	..	..	..	..	..	..	..	..
9	70	30	10,330	..	..	..	..	..	..	..	..	..	..
Average 8 hours.			10,300	..	533	1·68	1·89	3·24	0·46	10·40	29·3	53·7	1·0

TABLE III.

HORIZONTAL RETORTS.

Derbyshire Coal.—Charge, 13 cwt.; Weight of Coal Used, 3·9 tons.

ACTUAL TESTS.

No. of Hours after Charging.	Make per Hour.	Make per Ton per Hour.	Make per Ton.	I.P. No. 2.	C.V. Net.	H_2S.	CO_2.	C_nH_m.	O.	CO.	CH_4.	H.	N.
	Cubic Feet.	Cubic Feet.	Cubic Feet.										
1	3050	780	780	24·55	715	1·15	2·51	5·97	0·34	8·81	44·5	33·1	4·8
2	5350	1370	2,150	20·20	594	1·85	2·80	4·93	0·50	8·94	34·2	40·6	8·0
3	5050	1300	3,450	19·25	562	2·20	2·80	3·91	0·58	9·44	34·0	44·6	4·7
4	4800	1230	4,680	19·10	564	1·83	2·80	4·18	0·32	9·49	30·7	47·8	4·7
5	4450	1140	5,820	18·70	553	1·60	2·48	3·42	0·41	9·69	32·2	46·4	5·4
6	4300	1110	6,930	18·35	515	1·43	2·29	2·63	0·35	9·68	29 0	51·5	4·5
7	3850	990	7,920	17·05	500	0·95	2·00	2·28	0·36	12·19	27·1	52·4	3·7
8	3700	950	8,870	14·50	475	0·70	1·97	2·03	0·31	9·69	25·3	56·8	4·0
9	3300	840	9,710	11·75	443	0·50	1·51	1·16	0·22	9·98	23·0	59·4	4·7
10	2100	540	10,250	6 10	395	0·43	1·32	1·00	0·46	9·66	18·7	62·2	6·7
11	1650	430	10,680	1 90	332	0·30	0·83	0·36	0·23	11·25	13·5	65·8	8·0
12	1000	250	10,930	0·10	316	0·28	0·83	0·07	0·25	9·50	12·8	64·6	11·9
13	560	140	11,070	..	..	..	0·67	0·00	0·26	11·30	8·7	65·8	13·3
14	310	80	11,150	..	..	..	0·58	0·00	0·12	12·17	7·7	66·1	13·3
15	200	50	11,200	..	..	..	..	..	..	..	..	..	13·4

TESTS CORRECTED TO 1 PER CENT. N.

1	2930	750	750	..	742	1·19	2·61	6·20	0·35	9·16	46·3	34·4	1·0
2	4980	1270	2,020	..	635	1·98	3·00	5·28	0·54	9·56	36·9	43·7	1·0
3	4870	1250	3,270	..	583	2·28	2·90	4·06	0·60	9·80	35·3	46·5	1·0
4	4630	1190	4,460	..	585	1·90	2·92	4·26	0·33	9·88	31·9	49·7	1·0
5	4270	1090	5,550	..	577	1·67	2·60	3·57	0·43	10·11	33·7	48 6	1·0
6	4170	1070	6,620	..	533	1·48	2·37	2·73	0·36	10·03	30·1	53·4	1·0
7	3750	960	7,580	..	513	0·98	2·06	2·34	0·37	12·53	27·9	53·8	1·0
8	3600	920	8,500	..	494	0·72	2·03	2·09	0·32	9·96	26·1	58·5	1·0
9	3160	810	9,310	..	459	0·52	2·07	1·20	0·23	10·20	23·8	61·5	1·0
10	1990	510	9,820	..	417	0·45	2·11	1·06	0·49	10·24	19·6	65·5	1·0
11	1550	400	10,220	..	355	0·32	0·89	0·39	0·25	12·05	14·5	70·9	1·0
12	870	220	10,440	..	350	0·31	0·93	0·08	0·28	10·68	14·4	72·6	1·0
13	490	130	10,570	..	..	..	0·74	0·00	0·30	12·88	9·9	75·2	1·0
14	270	70	10,640	..	..	..	0·66	0·00	0·14	13·91	8·8	75·5	1·0
15	180	40	10,680	..	..	..	..	..	..	..	..	..	..
Average 12 hours			10,440	..	540	1·38	2 50	3·25	0·40	10·28	30·8	51·8	1·0

TABLE IV.

HORIZONTAL RETORTS.

Derbyshire Coal.—Charge, 13 cwt.; Weight of Coal Used, 3·9 tons + 12·5 per cent. Water.

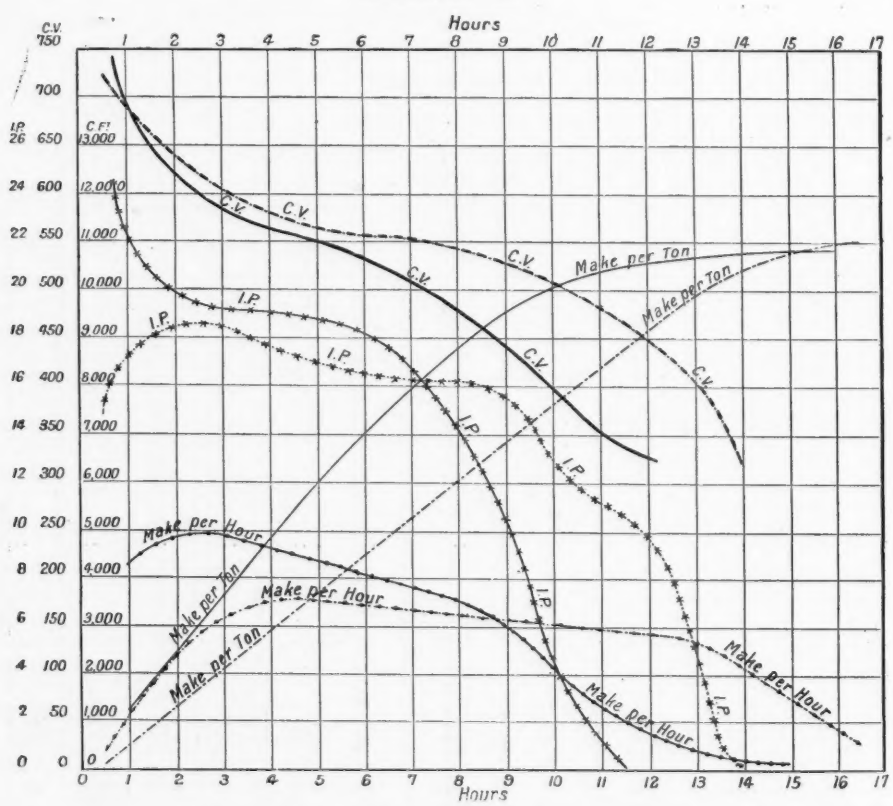
ACTUAL TESTS.

No. of Hours after Charging.	Make per Hour.	Make per Ton per Hour.	Make per Ton.	I.P. No. 2.	C.V. Net.	H_2S.	CO_2.	C_nH_{2n}.	O.	CO.	CH_4.	H.	N.
	Cubic Feet.	Cubic Feet.	Cubic Feet.										
1½	2200	..	560	17·18	653	4·70	4·43	7·32	0·73	9·02	40·9	32·2	5·4
2½	3000	750	1,310	18·70	599	2·85	4·91	5·92	0·46	8·53	35·2	39·6	5·4
3½	3500	900	2,210	16·85	579	3·50	4·81	5·63	0·63	9·19	32·5	42·0	5·3
4½	3750	950	3,160	17·62	549	3·45	4·72	4·60	0·20	10 09	31·2	42·3	6·9
5½	3700	950	4,110	17·00	534	2·20	4·44	4·89	0·76	9·88	29·0	42·3	8·7
6½	3600	900	5,010	15·95	530	1·60	3·96	4·17	0·61	8·58	29·0	46·7	7·0
7½	3500	900	5,910	15·95	524	1·60	3·85	3 66	0·59	9·89	29·0	47·2	5·8
8½	3150	870	6,780	16·03	505	1·60	3·47	2·72	0·36	9·52	29·0	46·7	8·2
9½	3250	850	7,630	15·58	488	1·60	3·23	2·23	0·49	9·56	26·9	48·6	9·0
10½	3300	850	8,480	12·23	455	1·60	3·22	1·81	0·27	9·68	24 7	49·8	10·5
11½	3250	850	9,330	11·00	443	0·65	2·76	1·54	0·35	9·88	24·9	48·4	12·2
12½	3200	820	10,150	9·38	419	0·60	2·42	1·32	0·36	10·08	22·1	53·4	11·3
13½	2850	720	10,870	2 45	348	0·30	1·80	0·51	0·32	10·49	16·0	55·7	15·2
14½	2050	530	11,400	..	278	0·00	0·50	0·00	0·10	11·0	8·0	62·4	18·0
15½	1350	350	11,750	..	..	0 00	..	..	..	..	..	..	18 0
16½	700	170	11,920	..	..	0 00	..	..	..	..	..	..	18·0

TESTS CORRECTED TO 1 PER CENT. N.

1½	2100	..	550	..	692	4·91	4·62	7·68	0·76	9·44	42·8	33·7	1·0
2½	2800	720	1,270	..	625	2·97	5·14	6 17	0·49	8 91	36·8	41·5	1·0
3½	3350	850	2,120	..	624	3·65	5 05	5·89	0·66	9·58	33·9	43·9	1·0
4½	3550	900	3,020	..	581	3·65	5·01	4·89	0·21	10·69	33·3	44·9	1·0
5½	3450	900	3,920	..	575	2·38	4·79	5 29	0·86	10·65	31·5	45·9	1·0
6½	3400	850	4,770	..	561	1·69	4·22	4·44	0·66	9·09	30 8	49·8	1·0
7½	3300	830	5,620	..	549	1·68	4·02	3·87	0·63	10·37	30·5	49·6	1·0
8½	3200	820	6,440	..	541	1·71	3·73	2·93	0·39	10·25	31·3	50·4	1·0
9½	3050	770	7,210	..	527	1·73	3·49	2·43	0·50	10·33	29·3	52·9	1·0
10½	3000	770	7,980	..	498	1·75	3·53	1·99	0·33	10·63	27·6	54·9	1·0
11½	2900	750	8,730	..	493	0·72	3·04	1·77	0·40	10·99	28·3	54·5	1·0
12½	2850	730	9,460	..	462	0·66	2·65	1·46	0·40	11·10	24·5	58·9	1·0
13½	2450	630	10,090	..	397	0·34	2·06	0·59	0·36	11·99	18·8	65·2	1·0
14½	1750	450	10,540	..	325	0·00	0·53	0·00	0·11	12·9	10·9	74·5	1·0
15½	1150	300	10,840	..	..	0·00	..	..	..	..	..	..	1·0
16½	550	150	10,990	..	..	0·00	..	..	..	..	..	..	1·0
Average 16½ hours			10,990	..	515	1·96	3·72	3·50	0·48	10·51	29·1	51·7	1·0

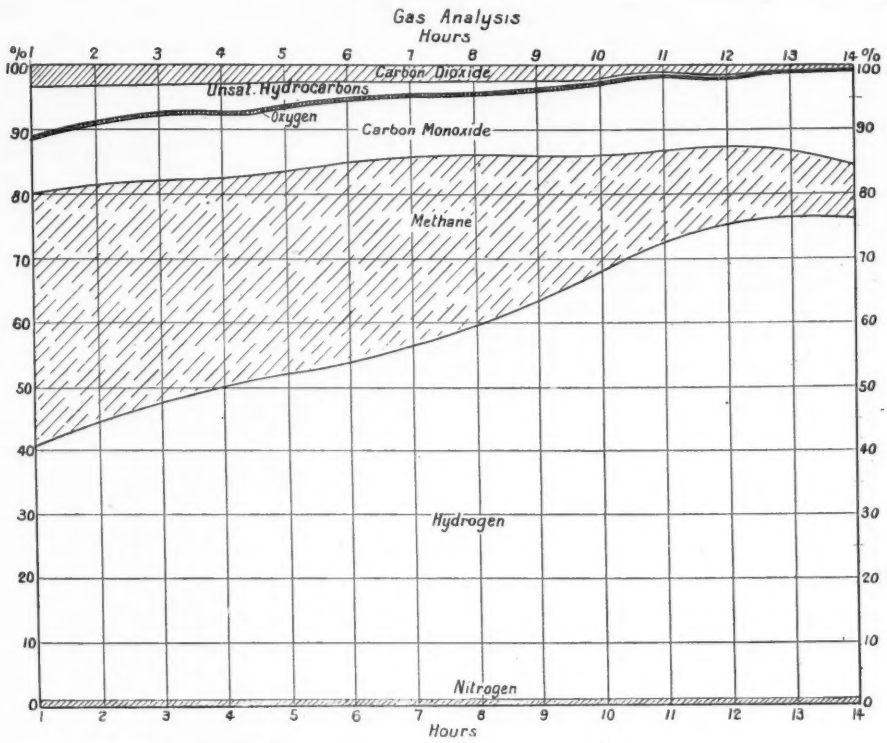
DIAGRAM B.



CARBONIZING TEST.—HORIZONTAL RETORTS.

CONDITIONS—CHARGE, 13 CWT. LEVEL GAUGE. NO SEAL—FULL LINES.
,, (WITH 12½ p.c. H_2O). ,, ,, —BROKEN LINES.

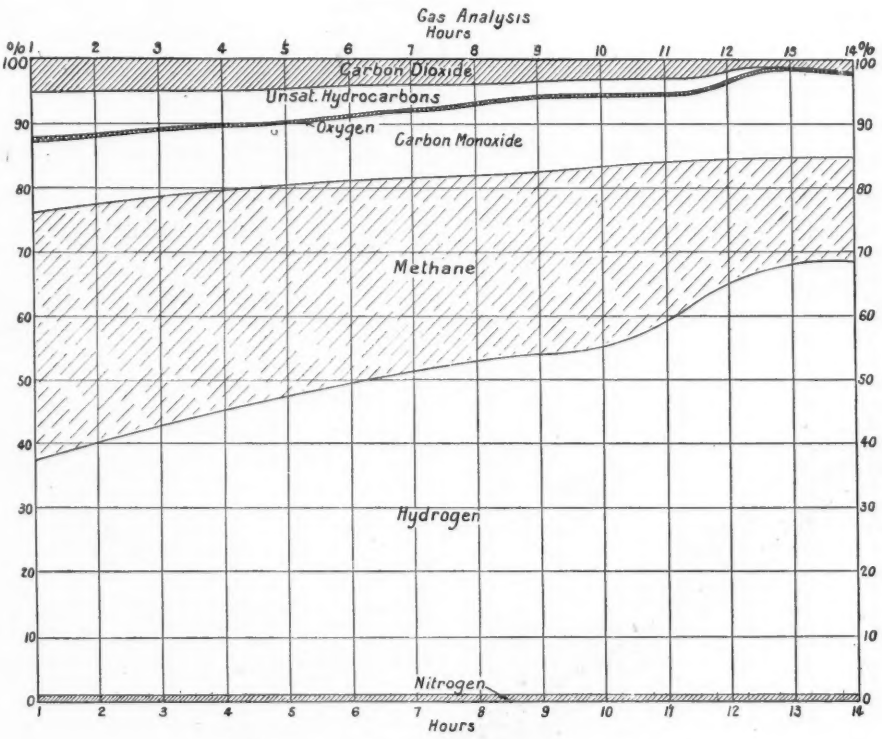
DIAGRAM (b).



CARBONIZING TEST.—HORIZONTAL RETORTS.

CONDITIONS—CHARGE, 13 CWT. LEVEL GAUGE. NO SEAL.

DIAGRAM (c).



CARBONIZING TEST.—HORIZONTAL RETORTS.

CONDITIONS—CHARGE, 13 CWT. + 12½ p.c. H_2O. LEVEL GAUGE. NO SEAL.

TABLE V.

VERTICAL RETORTS.

Derbyshire Coal.—Charge, 7·99 cwt.; Weight of Coal Used, 4·79 tons.

ACTUAL TESTS.

No. of Hours after Charging.	Make per Hour.	Make per Ton per Hour.	Make per Ton.	I.P. No. 2.	C.V. Net.	H_2S.	CO_2.	C_nH_m.	O.	CO.	CH_4.	H.	N.
	Cubic Feet.	Cubic Feet.	Cubic Feet.										
1	6550	1,350	1,350	17·80	584	1·35	3·47	4·08	0·37	9·13	33·7	43·2	6·0
2	6800	1,450	2,800	16·30	557	1·28	3·24	3·78	0·39	9·40	33·4	44·4	5·2
3	6300	1,300	4,100	15·65	517	1·20	3·00	3·47	0·41	9·67	33·1	45·7	4·4
4	6100	1,250	5,350	15·35	497	1·18	2·50	3·05	0·46	10·06	30·6	48·2	5·3
5	6000	1,250	6,600	14·65	477	1·15	2·00	2·62	0·50	10·44	28·1	50·4	6·2
6	5700	1,200	7,800	13·20	474	0·66	1·51	2·44	0·63	11·40	26·4	52·4	5·4
7	5450	1,150	7,950	10·30	438	0·51	1·18	1·05	0·45	11·30	19 9	60·1	5·7
8	4900	1,050	9,000	6·85	385	..	0·85	0·65	0·25	11·20	13·3	67·7	6·2
9	3650	750	9,750	2·87	315	..	0·85	0·58	0·20	11·55	12·0	65·8	8·8
10	2100	450	10,200	1·10	291	..	0 70	0·53	0·36	12·46	9·1	65·4	11·3
Steam on—													
11	4900	1,020	11,220	..	290	..	1·72	0·21	0·27	41·4	3·1	49·4	3·9
12	4550	950	12,170	..	283	..	1·94	0·00	0·11	44·6	2·5	46·5	4·2
13	5550	1,150	13,320	..	284	..	1·55	0·20	0·25	45·2	2·1	43·9	6·8
14	5250	1,100	14,420	..	..	..	1·97	0·22	0·31	45·7	2·0	44·9	5·1
15	1750	350	15,770	..	..	..	1·99	0·16	0·10	45·6	2·1	45·2	5·1
..	..	15,770	..	..	..	..	..	..	..	..	..	..	..

TESTS CORRECTED TO 1 PER CENT. N.

1	6220	1,300	1,300	..	613	1·42	3·64	4·10	0·38	9·59	36·1	46·2	1·0
2	6500	1,350	2,650	..	580	1·33	3·38	3·92	0·41	9·90	34·9	46·5	1·0
3	6070	1,270	3,920	..	535	1·24	3·11	3·59	0·42	10·10	34·3	47·5	1·0
4	5970	1,230	5,150	..	518	1·23	2·62	3·18	0·48	10·50	31·9	50·3	1·0
5	5700	1,200	6,350	..	502	1·21	2·12	2·76	0·53	10·99	29·6	53·0	1·0
6	5400	1,130	7,480	..	496	0·69	1·58	2·55	0·68	11·90	27·6	54·7	1·0
7	5230	1,100	8,580	..	457	0·53	1·24	1·11	0·48	11·86	21·1	63·2	1·0
8	4670	970	9,550	..	405	..	0·89	0·68	0·26	11·78	14·1	71·3	1·0
9	3400	700	10,250	..	340	..	0·92	0·63	0·22	12·54	13·2	71·5	1·0
10	1930	400	10,650	..	321	..	0·77	0·58	0·40	13·94	10·3	73·0	1·0
Steam on—													
11	4600	960	11,610	..	298	..	1·77	0·22	0·28	42·6	3·3	50·8	1·0
12	4430	920	12,530	..	292	..	2·00	0·00	0·12	46·2	2·6	48·1	1·0
13	5300	1,100	13,630	..	300	..	1·64	0·21	0·26	48·0	2·2	46·7	1·0
14	4880	1,050	14,680	..	..	..	2·06	0·23	0·32	47·6	2·1	46·7	1·0
15	1670	340	15,020	..	..	..	2·05	0·17	0·10	47·5	2·2	47·0	1·0
		15,020											
Average { 10 hours			10,650	..	500	..	2·25	2·63	0·43	11·00	27·5	55·2	1·0
Average { 12 ,, (2 hours steaming)			12,530	..	469	..	2·20	2·29	0·41	16·00	23·7	54·4	1·0

is almost entirely dependent on the 3 per cent. or so of ethylene *plus* benzene, while methane with a calorific value of 897 materially helps the heat value. Excess of hydrogen (calorific value = 268) helps to swell the yield of gas from the vertical retorts, but lowers the heating value.

When steam is turned on, the yield of gas per hour increases rapidly until it is equal to anything up to 12 per cent. of the total, according to the pressure of steam used. Two hours steaming produces an additional yield of at least 20 per cent., without any difficulty. The water gas thus produced is superior to the water gas made in a generator from coke by the ordinary intermittent method. Its calorific value is some 5 or 6 per cent. higher, and it contains not more than 2 per cent. of CO_2, as against at least 4 per cent. in ordinary water gas. The CO_2 content has an important bearing on the illuminating power; 1 per cent. effecting a reduction of about half-a-candle in a 15-candle gas.

A small and uncertain amount of unsaturated hydrocarbons continues to be given off during the hours of steaming, while methane is always present in appreciable quantities.

Ordinary Derbyshire coals do not lend themselves so well to steaming as rich coals, such as those of Yorkshire or Durham. The results obtained by distilling a moderately good Yorkshire coal for ten hours, and subsequent steaming, are tabulated below. The higher candle power and calorific value of the gas allow the introduction of a large proportion of diluent in the shape of water gas without lowering the quality of the mixed gases below statutory requirements. In this particular case, there is an addition of more than 15 per cent. of water gas, and yet there is only 1·72 per cent. of CO_2 in the mixture, with the respectable amount of 3·49 per cent. of unsaturated hydrocarbons.

[For the remainder of the Table and Diagrams referred to, see pp. 887-89.]

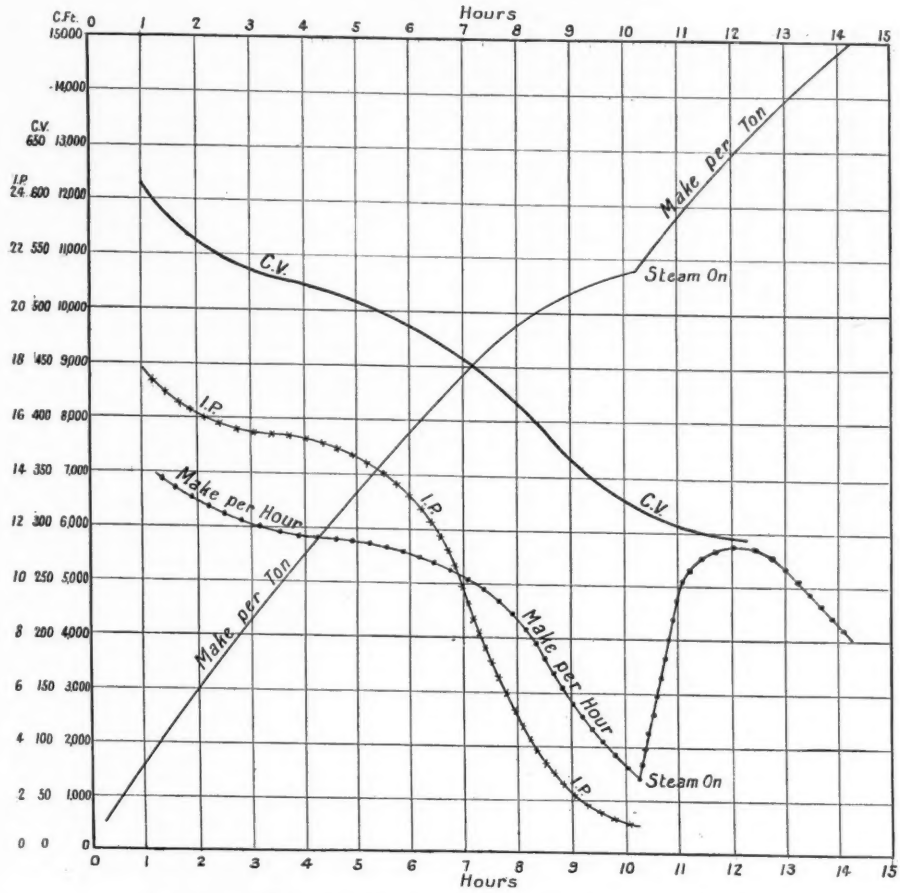
Masonic—Murdoch Lodge.

The installation meeting of this Lodge last Thursday, at the Imperial Hotel, Birmingham, was largely attended by not only members, but visitors from London and many Provincial centres. The new W.M., W. Bro. Charles Dakin, P.M., No. 573, and P.G.S.W. (Worcestershire) was installed in the chair by W. Bro. Charles Meiklejohn, P.M., No. 502, P.P.G.A.D.C., P.P.G.S.W. (Warwickshire); and subsequently W. Bro. Thomas Berridge, P.M., No. 1085, P.P.G.D., was invested as Treasurer. The other Officers of the Lodge invested were: W. Bro. C. Meiklejohn, I.P.M.; W. Bro. Vincent Hughes, S.W.; W. Bro. A. T. Harris, J.W.; W. Bro. Luke B. Taylor, Chaplain; W. Bro. Adam Cooke, Secretary; Bro. S. O. Stephenson, S.D.; Bro. S. P. Thornton, J.D.; W. Bro. Fred Vale, D.C.; Bro. Alfred Bird, Assistant D.C.; W. Bro. Thomas Cash, Charity Steward; Bro. A. C. Scrivener, Organist; Bro. Harold G. Eveson. Assistant Secretary; Bro. W. J. R. Baker, I.G.; Bros. Robert Scott, W. J. Woodfine, and Frank Jervis, Stewards. The Deputy Provincial Grand Master of Warwickshire, W. Bro. George Beech, J.P., P.G.D., of England, was present, and assisted W. Bro. Meiklejohn in the installation ceremony. Since the consecration of the Lodge last year, the long list of founders has been added to by the admission of seven initiates and six joining members. W. Bro. Dakin, the new W.M. of the Murdoch Lodge, was initiated in the Perseverance Lodge, No. 573, in October, 1886; was Master in 1898; Secretary for the past eleven years; and has continuously filled various offices in the Lodge for the last twenty-four years. He is P.Z. of the Royal Standard Chapter, No. 498; and was Scribe E. for some time. He was a Founder and P.Z. of Perseverance Chapter, No. 573; Scribe E. for some time; Prov.S.G.D. 1900 and Prov.G.J. 1906; and P.E.P. of the Richard de Vernon Preceptory.

Electricity Publicity Literature.

Apparently there is a bit of a slump in electricity publicity literature. The Electricity Press, Limited, whose address is in the Strand, have sent round a circular announcing a stock-taking sale of publicity literature, "indispensable to central station engineers and contractors for canvassing consumers and prospective consumers." This literature is offered at reduced prices "to make room for new stock." These are rather interesting statements. They indicate that the indispensability of this particular literature has not assisted in its clearance at ordinary prices; so that there has been a want of appreciation somewhere. Further, the special offer is with the view of making room for new stock. Now if electricity literature is indispensable, we should think that central station engineers would prefer some of the new rather than the old stock, and would wish not to insult present and prospective consumers by sending them old literature purchased at reduced prices. Neither is it kind to the literature to publish the fact that it has not exhausted itself, though "indispensable," at the ordinary published rates. We see that one of the leaflets is on the melancholy subject of "The Passing of the Gas-Engine;" and this while gas-engine producing shops are all being largely extended, and high dividends are being paid. There must be a mistake somewhere, or there has been an extraordinary flight of imagination. This advertisement of the fact that there is electricity literature for sale at reduced prices is given here quite free, as one wandering copy of the circular took the wrong turning, and was found in the letter-box of a gas company's office.

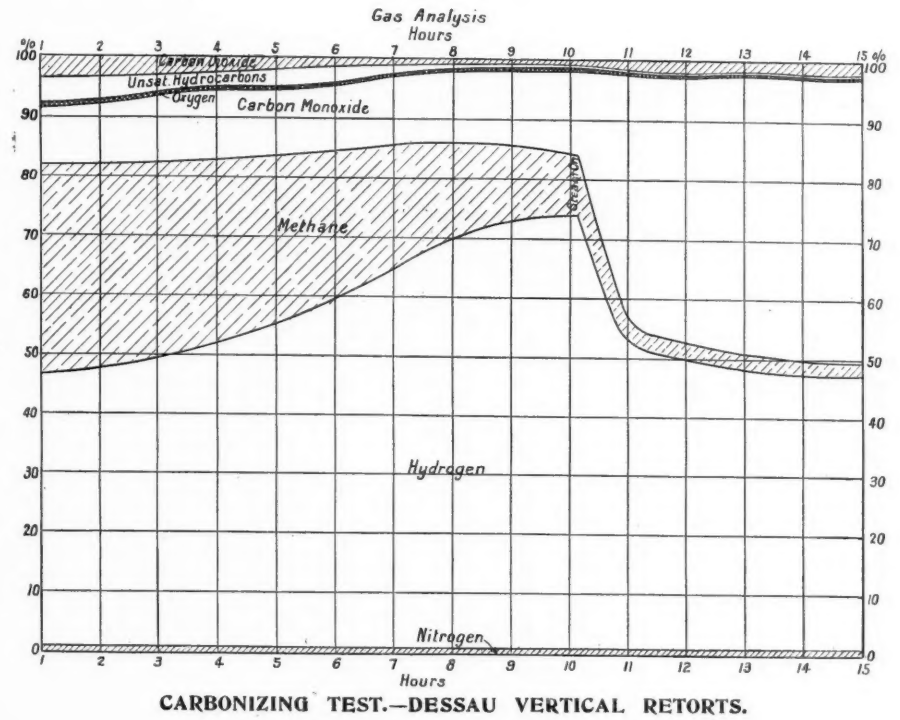
DIAGRAM E.



CARBONIZING TEST.—DESSAU VERTICAL RETORTS.

CONDITIONS—LEVEL GAUGE. NO SEAL. STEAMING. DERBYSHIRE COAL.

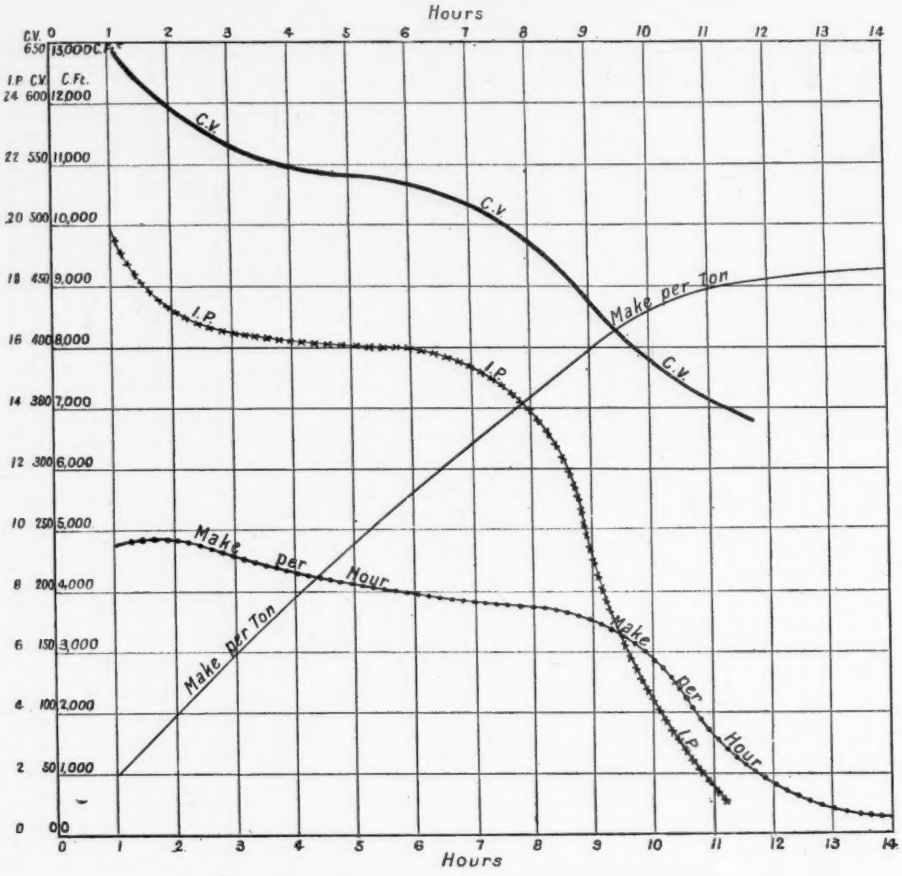
DIAGRAM (d).



CARBONIZING TEST.—DESSAU VERTICAL RETORTS.

CONDITIONS—LEVEL GAUGE. NO SEAL. STEAMING.

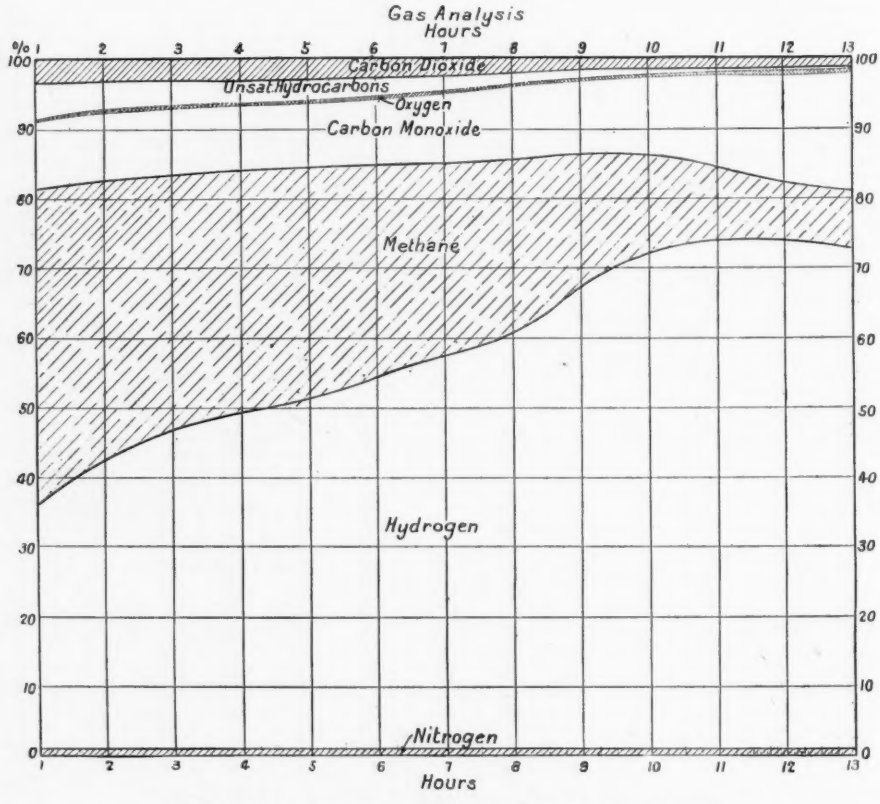
DIAGRAM F.



CARBONIZING TEST.—DESSAU VERTICAL RETORTS.

CONDITIONS—LEVEL GAUGE. NO SEAL. NO STEAMING. DERBYSHIRE COAL.

DIAGRAM (e).



CARBONIZING TEST.—DESSAU VERTICAL RETORTS.

CONDITIONS—LEVEL GAUGE. NO SEAL. NO STEAMING.

TABLE VI.

VERTICAL RETORTS.

Yorkshire Coal.—Charge, 7·7 cwt.; Weight of Coal Used, 6·90 tons.

ACTUAL TESTS.

No. of Hours after Charging.	Make per Hour.	Make per Ton per Hour.	Make per Ton.	I.P. No. 2.	C.V. Net.	H_2S.	CO_2.	C_nH_m.	O.	CO.	CH_4.	H.	N.
	Cubic Feet.	Cubic Feet.	Cubic Feet.										
1	12,750	1,850	..	25·10	602	1·55	1·45	5·77	0·96	6·77	42·2	38·3	4·3
2	9,250	1,340	3,190	24·15	581	1·50	1·73	5·26	0·67	6·92	38·1	42·6	3·6
3	8,050	1,160	4,350	22·90	585	1·45	2·00	4·75	0·38	7·07	36·2	46·8	2·8
4	7,850	1,140	5,490	19·60	554	1·48	2·07	4·37	0·39	7·02	34·5	48·8	3·1
5	7,550	1,090	6,580	18·46	542	1·50	2·13	3·98	0·39	6·27	32·7	50·7	3·3
6	7,400	1,080	7,660	17·10	521	1·35	1·98	3·54	0·42	6·58	30·0	53·6	3·6
7	7,250	1,050	8,710	15·50	480	1·20	1·83	3·09	0·44	6·19	27·3	56·9	3·9
8	6,350	930	9,640	12·40	444	1·15	1·56	2·42	0·33	5·95	22·4	62·5	4·8
9	4,850	700	10,340	5·52	369	1·10	0·83	1·07	0·84	6·25	15·2	67·8	7·8
10	3,550	520	10,860	..	324	0·10–	0·77	0·50	0·60	7·78	9·8	67·8	12·5
Steam on—													
11	5,400	780	11,640	..	285	1·00	1·00	0·57	0·53	32·2	2·4	56·4	7·1
12	8,150	1,180	12,820	..	289	1·15	1·78	0·00	0·32	39·7	2·0	52·3	4·1
13	8,110	1,170	13,990	..	282	1·15	3·80	0·30	0·55	40·2	1·1	50·6	3·4
14	7,900	1,140	15,130	..	279	0·40	4·00	0 11	0·57	41·2	0·3	49·0	4·7
15	7,800	1,130	16,260	..	..	0·30	4·42	0·13	0·45	41·4	0·6	48·3	4·7
..	..	16,260	..	..	..	..	..	..	..	..	..	..	..

TESTS CORRECTED TO 1 PER CENT. N.

1	12,370	1,790	..	..	622	1·60	1·52	5·98	0·99	6·99	43·9	39·6	1·0
2	9,000	1,300	3,090	..	596	1·54	1·79	5·44	0·69	7·06	39·7	44·3	1·0
3	7,880	1,140	4,230	..	595	1·48	2·04	4·85	0·39	7·20	36·9	47·6	1·0
4	7,690	1,120	5,350	..	565	1·51	2·11	4·46	0·40	7·13	35·1	49·8	1·0
5	7,380	1,070	6,420	..	554	1·53	2·16	4·05	0·40	7·20	33·4	51·8	1·0
6	7,340	1,050	7,470	..	535	1·39	2·04	3·65	0·43	6·78	30·8	55·3	1·0
7	7,050	1,020	8,490	..	494	1·23	1·88	3·18	0·45	6·38	28·3	58·8	1·0
8	6,200	900	9,390	..	461	1·19	1·64	2·53	0·34	6·19	23·8	64·5	1·0
9	4,600	670	10,060	..	394	1·17	0·89	1·14	0·90	6·67	16·6	72·8	1·0
10	3,250	470	10,530	..	361	0·11–	0·86	0·57	0·67	8·69	11·7	76·5	1·0
Steam on—													
11	5,060	730	11,260	..	302	1·06	1·06	0·60	0·56	34·0	2·9	59·9	1·0
12	7,890	1,170	12,430	..	291	1·19	1·80	0·00	0·33	40·9	2·7	53·3	1·0
13	7,770	1,140	13,570	..	289	1·18	3·91	0·31	0·57	41·2	1·2	51·8	1·0
14	7,650	1,100	14,670	..	287	0·41	4·10	0·12	0·59	42·9	0·3	51·0	1·0
15	7,510	1,090	15,760	..	..	0·31	4·58	0·14	0·47	42·5	0·6	50·7	1·0
		15,760											
Average { 10 hours			10,530	..	552	1·38	1·75	4·06	0·58	6·94	32·3	53·4	1·0
Average { 12 ,, (2 hours steaming).			12,430	..	506	1·34	1·72	3·49	0·56	10·94	28·3	54·0	1·0

PEAT A SOURCE OF POWER-GAS AND AMMONIA.

Dr. A. Frank, Professor at Charlottenburg, presented a paper at the last meeting of the Association of Gas and Water Engineers of Lower Saxony, in which he discussed the question of the utilization of peat for the production of power gas and ammonia. A few of the points made in the course of his article, as published in a recent number of the "Journal für Gasbeleuchtung," may be of interest at the present time.

The author shows at the outset the quantities of coal and of brown coal or lignite raised in Prussia in recent years, and observes that there has been concurrently a reduction in the quantity of peat consumed. The falling off in the use of peat is mainly due to its large and variable content of moisture, and to its voluminous character. As a consequence of this, attempts to utilize it for industrial purposes, locomotive firing, and for the manufacture of gas, have hitherto proved unsuccessful. All projects for the utilization of peat as fuel have ultimately failed to show any economy as compared with coal firing in the production of (say) one ton of steam. In Holland, some success has been achieved in making use of the peat deposits; and at the present time about 13 million cubic yards of peat are dug per annum. But this removal of peat has a secondary object—viz., rendering a large area of soil fit for cultivation. These conditions do not apply so directly to the German and many other peat deposits. The total area of peat bogs in Germany is given as about 8690 square miles. But the native peat contains 88 to 90 per cent. of water, and only 10 to 12 per cent. of dry material; and, reckoning a depth of 10 feet from the surface, it follows that the dehydrated peat from an area of one acre would amount to at least 1195 tons, having a calorific power of 9000 to 10,800 B.Th.U. per lb.

Investigations made in conjunction with Dr. N. Caro with the Mond gas-producer showed that peat might be gasified in this producer while still containing 50 to 55 per cent. of water. Such a peat can be obtained without difficulty merely by air drying. A result of great technical importance was the recovery of 70 per cent. of the nitrogen of the peat in the form of sulphate of ammonia. The composition of the power gas obtained averaged as follows: Carbonic acid, 17·4 to 18·8 per cent.; carbonic oxide, 9·4 to 11 per cent.; hydrogen, 22·4 to 25·6 per cent.; methane, 2·4 to 3·6 per cent.; nitrogen, 42·6 to 46·6 per cent.; oxygen, only traces. The combustible constituents, therefore, amount to 36 to 39 per cent. by volume of the gas, and the calorific power averages 157 B.Th.U. per cubic foot. These results refer to peat containing about 50 per cent. of water. If the peat contains 65 to 70 per cent. of water, the amount of carbonic acid in the gas rises; but the total volume of gas produced is greater. The proportion of combustible constituents falls to 28·6 per cent. This gas could still be employed in an explosion engine. The experiments showed that the richer gas, containing 36 to 39 per cent. of combustible constituents, when used in a gas-engine, gave one effective horse-power per 85 cubic feet of gas consumed. The sulphate of ammonia recovered becomes the most important factor in computing the cost of the gas for power purposes. The other bye-products—such as tar, wood spirit, and acetic acid—may be, for the time being, disregarded. In computing the power from large installations, the author has therefore calculated on the basis of a yield of only 650 horse-power-hours per ton of dry peat, or per two tons of peat containing 50 per cent. of water.

A scheme for the utilization of peat in this manner was brought to fruition in the year 1910, when the erection of a power gas and electricity works, with plant of 3000 H.P., was begun on a spot adjoining the extensive peat bogs of Papenburg, some 19 miles from Osnabrück. One of three gas-engines, each of 1000 H.P., was erected and brought into use first. The three engines will dispose of the peat on 30 acres of bog per annum, and the subsoil on this area will be rendered available for cultivation. Regular working of the plant began on the 2nd of October last, and in October 286,046 units, and in November 428,870 units, of current were produced. The production of sulphate of ammonia was not started until the second half of October; and between then and the end of November 20 tons had been produced.

Use for Gas-Engine Exhaust and Jacket Water.—In an American works, a system has been successfully introduced for heating the shops by utilizing the heat in the exhaust gases from the engine cylinders, and also the hot water from the cylinder jackets. The heater is built up of cast-iron hollow ring sections, joined together by screwed nipples at the centres, and enclosed in a casing through which the exhaust gases pass. The hot water from the jackets is connected into the upper ring section. The water from the heater enters the heating-pipes at about 200° Fahr. The manufacture of the heater involves nothing but the casting of the sections in the foundry, the internal threading, and the screwing together by the nipples. In the summer, when there is no demand for hot water from the exhaust boiler, the boiler may be run dry, and it is stated to be as efficient a muffler for the exhaust then as when in use as a heater. When the gas-engine is not running, the heater may be kept in operation by placing a small furnace below it, and passing the hot gases from the furnace through the heater.

HIGH-PRESSURE GAS.

By E. W. Smith, M.Sc., of Birmingham.

[A Paper read before the Midland Junior Gas Association, March 23.]

It is not my intention this afternoon to try and present to you an exhaustive treatise on the subject of high-pressure gas. The whole question in its every aspect is but in its early infancy; and in many respects it is inevitable that it will take years of experience and experimenting before a complete understanding of the way to deal with gas under high pressure is reached.

There is no doubt that the most important branch to be considered is that of distribution. Upon this depends the success of any of the uses to which high-pressure gas may be put. I shall leave entirely out of account in this paper any question of the possibility or advisability of compressing gas on the consumers' premises. It is a common enough thing where no high-pressure main is available to instal a compressing plant; but where gas at high pressure can be obtained from the town's mains, there is no object in compressing gas for oneself, unless the pressure in the mains is insufficient.

Early History of High-Pressure Distribution.

The principle of distributing gas at high pressures dates back in England much longer than is generally supposed. I believe moderate pressures (28 inches water-gauge) were used at Beckton in 1877. Natural gas has been distributed over long distances in America for nearly thirty years at pressures ranging from 70 lbs. to over 100 lbs. to the square inch. In Europe, Mr. George Helps, of Nuneaton, was the first to adopt the American principle of distributing gas at higher pressures. He laid down 5 miles of high-pressure pipes, supplying outlying districts. The mains consisted of 3-inch bell-and-spigot steel pipe with lead joints, and 2-inch and 1-inch wrought-iron screwed pipe. The compressors delivered into a 15,000 cubic feet high-pressure gasholder at the works at 40 lbs. pressure. A regulator valve at the outlet of this tank reduced the pressure to 9 lbs. on the system. Individual house regulators were employed, reducing the pressure to from 3 inches to 20 inches.

It is interesting to note that Mr. F. S. Cripps, in 1902, proved prophetic when he wrote:

"I am confident there is much room for improvement in the matter of distribution of gas. The day will come when high-pressure gas will be distributed through small and sound mains, instead of large and leaky ones. Even now it is not uncommon to meet with a gas company whose unaccounted-for gas is from 15 to 20 per cent. of the make. If it be as little as 5 per cent., we rejoice. But I hope we shall see the day when it will be reduced to less than 1 per cent., and when a satisfactory system of occasionally testing all mains and services will be adopted.

"We all see that high-pressure gas-mains are being introduced in America—somewhat restricted at present, but capable of more all-round treatment. They have proved successful. Why not? What can be done with steam in this way can be better done with gas. High-pressure gas is useless, however, unless you have sound mains and services to convey it, and proper means of regulating its delivery to the consumers. The latter difficulty could be met by consumers' governors, or perhaps better by special burners.

"While speaking of high-pressure gas I have often thought that the time will come when gas will be both purified and stored at high pressure. We have got so into the habit of thinking that to deal with gas in the process of purification it is necessary that it should be in a highly expanded condition, that the bare suggestion of purifying compressed gas comes as a shock to the nerves. But time will prove. Gas, like electricity, is yet in its infancy—at any rate, so far as its economic handling and delivery are concerned."

Unaccounted-for Gas.

I have quoted this at length because, even though the question of distributing gas at high pressures has advanced enormously since the time the extract was written, much remains to be done; and a part of it remains suggestive even now. After all, it is only ten years since this comment was made. Gas is now being distributed at high pressures in a great number of places in England. I cannot think that, even in 1902, in the low-pressure mains, all the unaccounted-for gas was due to leaky mains. I anticipate there will still be unaccounted-for gas where high-pressure mains are used, and from which all possibility of leakage has been eliminated. The question of leakage is a supremely important one in high-pressure work. The smallest escape might soon assume large proportions. Joints and cocks that are tight for water, steam, or even air, are quite frequently found porous when gas is used. This is to be expected, because the ease with which the molecules of a fluid will pass through an orifice will vary inversely as the square root of the density of the fluid. An average coal gas has a density of ·45, compared with air, and hydrogen (one of the chief constituents of coal gas) a density one-sixth that of coal gas. It is highly probable that the gas escaping from slight leaks in high-pressure mains is entirely hydrogen—a fractional filtration taking place.

Jointing of Pipes, &c.

The value of lead joints, whether run or packed, will depend largely on the extent to which the mains are subject to considerable changes in temperature and excessive vibration from above. Lead is almost plastic. It easily flows over itself when subject to shearing pressure, and does not regain its original position when the pressure is released during the expansion or contraction of the cast-iron joints due to changes in temperature of the mains. This points to the necessity of laying lead-jointed mains deep, and sending the gas into the mains at as constant a temperature as possible. Where screwed steel pipes are used, it should be remembered that "Solvene" is a very good solvent for red lead; and any joint depending partly or wholly on red lead cannot be permanently satisfactory for gas at high pressures. This applies especially on the services. All cocks should be full-way, or as near so as can be. It should never be possible to hear gas passing through a cock, as may be the case where a narrow bored cock is placed on a service that is working at its full capacity without causing a considerable loss in pressure during transmission.

Measurement Difficulties.

The measurement of high-pressure gas is one of the great difficulties to be overcome. There seems no doubt that so far the only accurate method is that in which a governor is used before the meter and the gas measured at a constant pressure. Both wet and dry meters may be used in this way; but it is highly probable that the dry meter will prove in the long run the most useful for high pressures. The frequent watering of the wet meter is too great an inconvenience to be long borne. The rotary meter is very accurate within certain ranges of consumption; but the ranges are rather narrow, and the non-measurement of low consumption, and the difficulty of over-running, make them, under certain conditions, unreliable.

Best Working Pressure.

I am frequently being asked: "What is the best pressure to work at in the mains? You in Birmingham are working at 12 lbs. pressure; at Nuneaton, they have compressed to 100 lbs.; in America, much higher pressures are employed; in many installations in England pressures from 3 to 5 lbs. are the usual thing. Why do you work at 12 lbs. in Birmingham?" Pressure should be determined by the volume of gas at a given pressure required at a given point in a certain sized main. If you do not want to work at such a high pressure, then increase the size of the main accordingly. At present, for distribution purposes, 5 lbs. to the square inch would probably be all that is necessary; but after much experimenting, it has been found that, for certain classes of work general in Birmingham, the best results can be obtained, with the burner we employ, with the gas at a pressure of 12 lbs. I will go into this matter a little later. Nothing like this pressure is necessary in most high-pressure appliances. It is generally found that each type of heating appliances has its own pressure at which the greatest efficiency is obtainable.

Necessity for Constant Calorific Power and Density.

Most of us will agree with Mr. Forshaw, in his Manchester University lecture recently, in indicating the necessity of gas undertakings maintaining a more constant calorific value. The demand is not for a high calorific value gas, but for a gas of more constant heating power. Gas appliance makers would no doubt appreciate a constant calorific value common to all undertakings. As all appliances should be capable of adjustment, and as I am of opinion that the adjustment should not be left to the maker on his works but to the fitter who instals the appliance, it is only necessary that the gas used in a given appliance, once installed, should be as constant as possible in its calorific value.

A factor which is equally as important as the calorific value is the density of the gas. I believe that variations in the density affect results in heating processes equally as much as variations in the calorific value. Not only should there be, in order to ensure the best results in all gas heating processes, a certainty of constant calorific value, but also a certainty of a gas of as nearly as possible constant composition, ensuring a constant density.

Industrial Application of High Pressure.

It is only within quite recent years that high-pressure gas has been applied in industrial heating processes under conditions where low-pressure gas and air blast would otherwise be used. Mr. S. R. Barrett pointed out, before the Birmingham Master Gas-Fitters in 1909, that the first man in Birmingham to use gas industrially was a Mr. Pemberton, who, in 1808, employed gas soldering appliances. Mr. Onslow, late of the Woolwich Arsenal Gas-Works, and now of the Gaslight and Coke Company, was one of the pioneers in the use of high-pressure gas in workshop practice. The condition of things existent in Birmingham is almost unique. There are so many concerns (spread over a large area) in which high-pressure gas can be economically used, that the expense of carrying mains in all directions is more than justified by the increased consumption obtained by so doing. There are few towns so well placed as Birmingham in this respect. It must not be thought that I believe high-pressure gas superior to low-pressure gas for all purposes. For temperatures up to 1000° C., where soaking heats are required, low-pressure gas is quite equal to either high-pressure gas or air blast in conjunction with low-pressure gas, once the preliminary heating has been effected.

High-pressure gas appliances may be divided into two classes:

(1) Those in which a bunsen burner effect is required—usually obtained by means of ring-burners for quick heating.

(2) Those in which it is required to heat up fire-brick lined furnaces, such as crucible and annealing furnaces.

In the one it is necessary to maintain distinct flames of the blow-pipe type. In the second, the only necessity is that the correct mixture of air and gas should reach the zone to be heated. The first is usually used for heating-up liquids, such as sugars and varnishes, in metal pans. The American Furnace Company supply admirable air-blast burners for this type of work.

Points regarding Burners.

It will perhaps be useful to discuss for a moment the reason why, by means of air blast and low-pressure gas, much quicker working is obtainable, and, consequently, much better efficiencies effected, than when using low-pressure gas and atmospheric air alone. Town gas usually requires about 5 volumes of air for complete combustion. Of course, however the gas is burnt, if it is completely burnt, the same amount of heat will be liberated. If the same amount of heat can be caused to be liberated or generated in a smaller space, then the temperature of the gases in that space will momentarily be at a higher temperature. When the gas is completely and efficiently mixed with air before combustion takes place, the resultant flame will be much smaller, and at a much higher temperature—the heat has been concentrated into a smaller flame volume.

In the ordinary bunsen burner type of low-pressure appliance, it is only possible for the gas to draw in two to three parts of primary air to one of gas. The volume will depend on the amount of back-pressure in the expansion tube, and on the area of the holes from which the mixture of gas and air escapes immediately before combustion. The remaining necessary air is taken from the atmosphere in the same way as the luminous flat-flame obtains its air. If in this type of burner its mechanical construction were so arranged as to enable a larger volume of primary air to be taken in, the mixture would back-fire, owing to the speed of combustion being greater than the rate at which the mixture is passing through the burner. In the Mèker burner, this back-firing is prevented by the use of a nickel grid at the head of the burner. This grid cools down the part of the flame in contact with it sufficiently to prevent back-firing. Consequently, owing to the mixture of air and gas escaping from the burner being in more or less theoretical proportions requisite for complete combustion, the flame has a temperature which is higher by over 100° C. than that found in the ordinary bunsen burner. The temperature throughout the flame is very much more even. This is due to the fact that there is a much better mixture of primary air and gas, and a larger proportion of air, than is found in the usual bunsen burners. The air-blast bunsen gives very similar results to the Mèker, though the flames are not similar. The temperature of the flame is much higher than the low-pressure burner, and lighting-back is prevented because the velocity of the mixture of air and gas is maintained by the air under pressure.

When high-pressure gas is used in this type of burner—the size of the gas-jet having been correctly reduced, and the area of the burner hole or holes properly proportioned—a result is obtained that is a slight improvement on the Mèker burner. Very much more than the theoretical quantity of air may be injected. Consequently, when such ring burners are employed under metal boiling pans or vats, there is no need to provide for a secondary air supply; and if the burner is correctly designed and suitably placed in relation to the pan that is being heated, the products will not affect the flames in any way. There being a good and correct mixture of air and gas, the temperature of the flame is higher, and, as a result, the transference of heat from the flames to the material that is to be heated is quicker, and a higher efficiency, compared with the usual low-pressure flames, follows. There is almost a complete absence of local heating, as when the pan to be heated is placed in position there is a tendency for the flame to leave the burner, and a mass of gas and air is found round the pan undergoing concentrated combustion.

A high-pressure burner that has proved very efficient and extremely useful is one that has the form of a shallow collar box. The gas and air mixture enters at the bottom, through a properly dimensioned pipe; and the top is perforated with a number of holes of correct size for the range of consumptions required. However much air is allowed to be pulled forward by the gas under pressure, unless the pressure of the gas is reduced below 40 inches water-gauge, lighting-back is impossible. This type of burner is known as the chamber burner. The efficiency of such a burner, compared with a similar low-pressure burner, will depend on the process and appliance to which either is adapted.

My experience has been that in all cases the higher efficiencies are obtained when air blast or high-pressure gas and low-pressure gas injected air are used, compared with low-pressure gas and injected air. The difference may be as low as 5 per cent.; but under special circumstances the efficiency has been doubled. High-pressure burners of this type work quite well at a pressure of 60 inches water-gauge; but it is wisest to have a pressure of about 100 inches water-gauge available on the services, so that, where it is necessary to use a long expansion tube in connection with the burner (due to the large size of the vessel to be heated), there will be plenty of pressure to overcome the back-pressure of the lengthened expansion tube.

Experiments with Air Injection.

There is a big jump between this pressure of 100 inches water-gauge and the pressure of 12 lbs. to the square inch found most efficient in connection with metal-melting furnaces. I have just had completed a large series of experiments on the volume of air that can be injected through the high-pressure burner that is generally adopted in Birmingham for metal-melting furnaces. The burner was fixed on to the furnace, and all possible inlets for secondary air were closed. The flue was closed, so that there could be no "pulling" of air through the burner. The top of the furnace was left open sufficiently to allow the gas and air to escape. The pot was placed in the furnace, and all the conditions made to comply with working conditions. Arrangements were made for samples of the gas to be taken from the furnace when the gas was turned on. These samples were analyzed, and the proportion of air and gas present in the furnace determined. All the conditions were carefully checked; and the results proved very consistent. The gas and air during these experiments were allowed to flow through the furnace without being lighted. When the jet of the burner was in such a position that the largest possible volume of air could be carried forward, the proportion of gas to air found in the furnace was as 1:7. This volume of air is, of course, much too great, if this proportion were present when the furnace is lighted and heated up. The smaller the combustion space in crucible furnaces, the better are the results obtained. This space, however, must be sufficiently large to allow of the free flow of the combusting gases round the pot when the furnace is heated up to its maximum temperature.

The experiments were carried out in a cold furnace. The results showed that, under these conditions, the back-pressure due to the presence of the pot brought the proportion of gas to air down from 1:9 to 1:7. With the burner-jet still in the same position, and the gas consumption remaining the same, the furnace was lighted up; and after a temperature of about 1000° C. had been attained, samples of the gas found at the top of the furnace were abstracted and examined. The composition was such that, from calculation, it was found that the volume of gas to air passing from the burner into the furnace was slightly over 1:5; the theoretical mixture requisite for the complete combustion of the gas and air.

From these facts, it will be seen why, for high temperature work, we require a gas pressure of 12 lbs. to the square inch. A large margin of aëration is necessary to counteract the back-pressure of the furnace on the flow of the highly-expanded mixture of gas and air through it. The chimney pull through the flue may be used to overcome some of this back-pressure in the furnace; but it is unwise to employ this pull for any other purpose than that of abstracting the products of combustion from the furnace.

Popularity of High-Pressure Gas in Birmingham.

High-pressure gas is becoming very popular in industrial Birmingham, both for workshop lighting and for furnace heating. Its adaptability and simplicity of manipulation, especially in the latter case, appeal to the manufacturer; and it is no uncommon thing to hear one say that—provided it will do his work—he will adopt the high-pressure gas, even though it should cost him a little more than his present method. When it is explained that it will cost him less in nine cases out of ten, any doubts he might have remaining are immediately dispelled.

In Birmingham, the greatest increase in high-pressure gas consumption is in connection with metal melting. Ovens and annealing furnaces only require high-pressure gas or air-blast when they have to deal constantly with heavy work. Then it is necessary that the furnace should quickly recover its normal temperature after the work has been placed in the furnace. Generally, however, a well-designed low-pressure furnace will do all that is required in annealing and hardening.

Metal Melting by Gas.

In metal melting by means of gas, enormous strides have been made during the last few years. The one great necessity in all such installations is that there should be a constant and reliable supply of British thermal units from the burner.

I can now say with every confidence that the melting of metals by means of high-pressure gas on a commercial scale is an economical proposition, and has attained complete success. This is proved by the large number of firms in Birmingham that have installed, and are installing, high-pressure gas for metal melting. The whole process has been tested time after time in the severest way imaginable. Expert casters, uninitiated, prejudiced, and predisposed to older methods, have put the system through weeks of trial, and have criticized it from every point of view, and in most cases have adopted it. The demonstrating foundry built by the Birmingham Gas Department has more than justified its erection.

Furnace Results.

Without repeating similar tests to those I have already published, I am afraid I have very few fresh details of experiments to present to you. The best results in fire-brick built crucible furnaces are obtained when the combustion space is reduced to a minimum, dependent on maintaining a free flow of gases through the furnace, when the furnaces are lined with a sufficient thickness of fire-brick of a low conductivity, and when the top of the crucible is at least a foot below the top of the furnace.

Gas with a calorific value of about 520 B.Th.U. net appears to give the best results in furnace work. Richer gas requires more air for combustion; and the margin of air injected will be correspondingly cut down. To get the same results with gas of lower calorific value, a corresponding increase in the volume of gas used

would have to be made. In the event of the calorific value being very much reduced, equal results cannot be obtained when working under the same conditions, even though the consumption has been increased. With regeneration with such a gas, it might be possible; but for straight heating, low-grade gases do not give as good efficiencies as a better quality gas—more especially for high temperatures.

There is any amount of work to be done in improving the efficiencies of all types of gas-heated furnaces, though they now compete well with other methods of heating. The very competition of gas against these other methods is giving an impetus to the experimenters in other methods.

A Suggested British Research Laboratory.

In Birmingham, we are naturally experimenting and developing the heating systems peculiar—or nearly so—to Birmingham. We find that it pays. Could not something be done which would be of value to the whole industry? Is it too idealistic to hope for a British Gas Engineers' Technical Research Laboratory? If run on proper lines, the results obtained from such a laboratory would prove by far the best advertisement the gas industry could wish for. I should like to enlarge on this; but the subject hardly comes under the scope of the present paper.

Melting Nickel and Manganese Bronze, &c.

The latest success achieved in gas heating in Birmingham is in connection with the melting of nickel and manganese bronze. High-grade German silver, containing about 25 per cent. nickel, has been melted commercially for some time, at an average cost of £1 6s. 3d. per ton, with gas at 1s. 3d. per 1000 cubic feet. The metal is melted in 84 lb. lots, and each takes about an hour-and-a-half to run down. The preliminary heating up of the furnace takes about 45 minutes. This cost is included in the figure quoted. The cost to this firm, with coke and blast, varied between £2 and £3.

By manufacturers in Birmingham, 99 per cent. nickel is being melted economically compared with coke in high-pressure gas-furnaces. Manganese bronze, which requires a higher temperature than nickel, has been melted on a large scale; and the system will shortly be adopted in works in Birmingham. This metal is made by melting together ferro-manganese and a copper alloy. The fusion of the former is the most difficult problem we have yet tackled. Common brass is now being melted at a cost for fuel alone, in 60 to 200 lb. pots, averaging 5·5d. per cwt. High-pressure gas is being adopted by the silver and gold refiners for melting purposes. The cost in 90 lb. melts averages 7d. per cwt., with gas at 1s. 3d. per 1000 feet. This figure will be reduced when more experience has been gained in bullion melting with gas-furnaces.

Cleanliness and ease of control and adjustment give gas heating an enormous advantage over coke or oil furnaces. The wide range of manipulation and adaptation to all grades of work in hand, and also the ease with which the process may be shortened or lengthened to suit the convenience of the manipulator, without reducing appreciably the efficiency of the furnace, render this type of appliance invaluable.

As I said at the beginning of this paper, I have in no way attempted to give an exhaustive account of the subject of high-pressure gas. It has been my aim rather to discuss and elucidate (if possible) some of the points which arise in approaching high-pressure gas problems. I believe there is a great future for gaseous heating of all kinds. We need, however, to forge ahead—and to forge ahead quickly. It can be done; but it will be best done by combined action.

[Samples of the high-pressure burners referred to in the paper were exhibited at the meeting, and their special points were explained by the author.]

Discussion.

Mr. A. Hill (Birmingham) said Mr. Smith had referred to the Méker burner, and stated that the flame had a temperature which was higher by over 100° C. than that found in the ordinary bunsen burner having the same consumption. He was not quite sure what was meant by this. Then the author remarked that a gas with a calorific value of about 520 B.Th.U. net appeared to give the best results in furnace work, and that a richer gas required more air for combustion. Did it not also depend on the composition? Was it not possible to have a gas of 600 B.Th.U. which would only require the same amount of air for complete combustion as a gas of 520 B.Th.U.?

Mr. C. M'Pherson (Nechells) said that allusion was made in the paper to the action of solvene on the jointing material of the pipes. The author stated that it was a good solvent for red lead. Of course, solvene was introduced at the works now; but it was previously in the gas to a less extent, and always had the same effect on the jointing material. It was bad practice to depend upon lead for the jointing material at all. Litharge and glycerine had been found to be a very good mixture. Would it not be possible to try sometimes the coating internally of cast-iron mains to be used for high pressure with a mixture of litharge and glycerine, or some material of a similar description, which would close-up the porosity of the cast iron? Something of this kind seemed to him to be necessary. The inside of the pipes would require to be perfectly cleaned with steel wire brushes; and then the coating of this clean surface should be of great advantage in keeping the pipes tight. The metal used was another point in connection with high-pressure distribution mains, because the cast iron for gas-mains was of a very inferior quality. He would have thought that it would be quite simple for manufacturers to construct high-pressure lamps that would not make a noise. Why was it that the Germans seemed able to beat this country in the particular line of lamps for high-pressure lighting?

Mr. B. Skidmore (Smethwick) wished to know why the author had such a *penchant* for the dry meter. It seemed to him that the dry meter lent itself to great possibilities of inaccuracy of measurement. He had always thought that the compensating meter was the most accurate.

Mr. W. E. Cadwallader (Birmingham) pointed out that the author, speaking of unaccounted-for gas, said the smallest escapes might soon assume large proportions. Was there any possibility of the gas having a cutting action on a small leak? Supposing there was a pin-hole which the gas could get through, would its action on the hole be likely to increase the size of it? He would like to know what Mr. Smith would recommend for jointing purposes, and whether he had a special preparation. As to measurement, the members a short time ago saw a meter with an aneroid arrangement to adjust it to register gas at high pressure. Had this proved to be as successful as appeared likely to those who examined its construction? He could not quite understand the sentence in which the author said: "There are so many concerns spread over a large area in which high-pressure gas can be economically used that the expense of carrying mains in all directions is much more than justified by the increased consumption obtained by so doing." The question arose in his own mind whether they would likely get an increased consumption by carrying high-pressure mains all over their districts. He assumed that manufacturing districts only were referred to; but there were a great many people who were at present using low-pressure gas for manufacturing purposes. Possibly many of them would go in for high pressure, especially if they found it more economical; but this would hardly suit the gas undertakings. Increased consumption was only to be obtained when gas was going to replace coal or other fuel. In the portion of the paper referring to experiments with air injection, the author said that when the jet was in such a position that the largest possible volume of air could be carried forward, the proportion of gas to air found in the furnace was as 1 : 7; and then lower down he said that the back-pressure due to the presence of the pot brought the proportion of gas to air down from 1 : 9 to 1 : 7. Perhaps he would explain this. Was there any likelihood of the noise made by high-pressure furnaces being done away with? Of course, the noise with high-pressure lamps, which had been mentioned by a previous speaker, was over in a few minutes—as soon, in fact, as the fitter could get at it and put the matter right—but he was led to understand that the furnaces did make a great deal of noise, and that this was one of the greatest objections to them.

Mr. G. C. Pearson (Birmingham), referring to the statement of the author that a calorific value of about 520 B.Th.U. net appeared to give the best results in furnaces, said it would be very interesting to know under what limits they should really work to get efficiency. It was apparent that, if they had a low-grade gas, with a low calorific value, the quantity of waste products would be naturally larger, and this carried away a portion of the heat of the furnace. With regeneration, it might be possible to keep up the efficiency; but there must come a time when even this would fail. It was a trend of the times for gas to become of lower grade; and the information he asked for would be useful. In regard to unaccounted-for gas, it was stated in the paper that with some companies this amounted to as much as 15 to 20 per cent. Of course, a great deal depended on the method of measuring. The station meter might be at fault; and then there was the important question of the way in which the gas was corrected for temperature and barometer—that was, whether it was corrected to the conditions under which it was going to be measured by the consumers' meters.

Mr. P. C. Balcon (Birmingham) thought it was a matter for congratulation that it had been possible to make use of high-pressure gas industrially to the extent that had been done. It was a splendid thing to be able to say that by means of gas supplied directly from the works, without any air blast or appliances for raising pressure or blowing, they had been able to melt pure nickel in anything like quantity. At the same time, he would like to ask Mr. Smith about this question of calorific value. He thought 520 B.Th.U. had been a pretty usual figure for town gas of about 16-candle power. The tendency, however, now was to materially lower this standard; and while he considered that it was possible to reduce the illuminating power standard pretty considerably, and yet maintain the calorific value at a fairly high figure, still 520 B.Th.U. seemed to him to be probably more than they were getting, for instance, in London, where the illuminating standard was 14 candles with the No. 2 "Metropolitan" burner. Was it possible to efficiently work a high-pressure furnace and melt pure nickel or manganese bronze with a gas of 500 B.Th.U.? If so, they had a splendid asset in high-pressure gas, and one that was worth every consideration that could possibly be given to it. The suggestion regarding a British research laboratory was a good one. This was a matter for the industry to take up and bring to a proper conclusion.

Mr. G. M. Lewis (Windsor Street) agreed that the wet meter and the rotary meter had grave faults, which they did not seem to be able to get over at present, and that to measure gas properly they would have to do it through a governor in front of the meter

at fixed pressures. As to noise with high-pressure lamps, even if there were a little, it must be remembered that with gas-engines in their early stages noise was their greatest advertisement; and if they could get the same success with high-pressure lighting as had been achieved with gas-engines, there would be nothing much to worry about.

Mr. W. Lycett (Birmingham) did not think that they were ever likely to make a successful joint with lead for high-pressure distribution. The best thing would be to go back to flanges; and probably some kind of washer of very soft iron between would take the place of the lead joint. Most of the leaks likely to arise would be not so much on the mains (because they could alter the quality of the iron to suit the requirements) as in connection with the lead, when expansion and contraction took place. This was the weak point. It was not wise to use anything in the nature of a tapered thread. The best kind of joint was a good long thread, as even and as square as possible. He would be glad to know what kind of bricks were used in the furnaces, because this would make a great difference in the life. Some bricks would split with the heat immediately; and others would melt down.

The President (Mr. R. J. Rogers, Birmingham) said the paper had been a most useful one; and it was very kind of Mr. Smith to come and read it. Many of the remarks made, both in the paper and the discussion, pointed to the necessity of some agreement being come to between manufacturers of cocks, pipes, &c. He would have liked to hear more of the latest tests with governors, because this was a question which was still not altogether satisfactory. Mr. Smith and Mr. Lewis both thought the best method of measuring high-pressure gas was by a dry meter with a governor in front of it. Here, again, the necessity was emphasized of getting a governor that would absolutely maintain the pressure as desired. One point that appealed to him particularly, as having to do with fitters, was the adjustment of apparatus. The author said the adjustment should be left to the fitter who installed the appliance. This was another of the increasing duties falling on the fitter; and it showed now much discretion he had to exercise. It pointed to the fact that the fitter of the future must be specially trained to this particular work. In thinking of what high-pressure gas could do, they did not want to forget low-pressure gas. With reference to the calorific value of gas, it had often struck him, hearing so much nowadays of the request for a calorific standard, that, as they were in some of the processes only just able to beat coke and other fuel by using high-pressure gas at the present standard, it would be well to know how far the value should be allowed to drop. If they went too low, they would possibly lose their advantage over other fuels—especially as other people were forging ahead with experiments. He quite agreed that something should be done with regard to a research laboratory. With high-pressure gas, as with many other things in the industry, combined action would no doubt save a lot of expense to individual undertakings. In conclusion, he moved a hearty vote of thanks to Mr. Smith for his paper.

Mr. W. J. Pickering (Windsor Street) seconded the proposition; and it was carried with acclamation.

Mr. Smith, after thanking the members for the manner in which they had received his paper, said that in preparing it he had to choose between giving a lot of figures and data and setting before them a general description of points that had arisen during the last twelve months or so, and which really required clearing up. He had come to the conclusion that the course he had taken would perhaps be the most useful one. A great many questions had been raised in the discussion; and to adequately deal with them all would need at least two more papers. He would, however, try to answer shortly some of the points. It was a recognized fact that the volume of gas burnt in a flame, the aëration being the same, did control the flame temperature. In discussing the question of flame temperature, it was necessary to be very explicit; but as flame was simply a continuous supply of energy known as heat, and the temperature was the registration (say) of the extent to which this energy had been disseminated, the rate at which it was lost (say) to the atmosphere would depend upon the temperature of the atmosphere. The larger the flame, the better would the average heat be maintained in the flame. That was to say, if they had a very little flame, this small amount of heat energy would be lost very quickly, and have practically no temperature at all; whereas with a big volume of flame the outside, which corresponded to the tiny flame, would be about the same temperature as the small flame, but the average temperature in the flame would be much higher, in proportion to the size of the flame. But they must remember that this was with the aëration always remaining the same. As a matter of fact, this was not absolutely correct, because they might maintain the same proportions of air and gas, and yet have a different type of flame. So that he should say, instead of the same aëration being maintained, the same apparent aëration being maintained. As to the question of 520 B.Th.U. being the best quality of gas for heating, as mentioned in the paper, his reason for giving this figure was a twofold one. In the first place, it was necessary for the calorific value of the gas to be constant at some figure—it did not matter what it was, within (say) 8 per cent. limit either way. Secondly, there should be a recognized thermal value for the gas for heating purposes. As to the efficiencies to be got by gases of different thermal values, he should say, from a few tests that had been made, over a range of not lower than about 450 B.Th.U. and not higher than 650 B.Th.U. net, the efficiencies would be much the same, if the gas consumption were varied correspondingly. The number of British thermal units put into the furnace would be approximately the same, if the construction of the furnace was varied to meet the conditions. Within this range of difference, any extra quantity of air, and consequently of nitrogen, having to be heated up would have a very small effect, because there be too high a range of temperature. In using the word solvene, he meant to include any of the light oils of a solvent nature that were deposited in the pipes. Glycerine and litharge might work very well, because the glycerine might not be affected as was the linseed or other oil used; but he did not know absolutely as to this. The porosity of cast-iron mains had been mentioned. So far in Birmingham, they had not practically had any difficulty in this connection; but it was a matter that could in any case be got over very easily. There had, however, been slight leaks in connection with the lead jointing, where expansion and contraction of the pipes had taken place; but the biggest leak ever found was one that raised a small soap-bubble, the size of a pin's head, at the end of four minutes, or something like it. He was afraid he could not recommend the type of pipes to be used for high-pressure mains. Distributing engineers and others who had had some experience with mains would be able to give a great deal more useful information than he could. The whistling of high-pressure lamps was a thing that could be, and had been, overcome. Where whistling had occurred, it had been mostly in connection with experimental lamps; and it was a matter of adjustment. German lamps might be superior in some respects to English ones; but in other ways they were very much inferior. They seemed to be giving a better light; but it would not be long before English lamps (if they did not already do so) would give an equally good light. He had been congratulated on the work done in the high-pressure laboratory; but he would like to emphasize the fact that any work done there had been done quite as much by those working with him as by himself, and had been inspired quite as much by their ideas as by his own. It was possible to melt nickel with gas of anything down to (say) 450 B.Th.U. It was a matter of furnace construction and gas consumption. This was a point that wanted specially bringing out; and he did not know whether he had really made it clear in the paper. At 12 lbs. pressure, the furnace burner generally used in Birmingham would inject 12 parts of air to 1 of gas. If it was put in the furnace, the furnace itself, without the pot inside, would get this down to 9 parts. Put a pot inside one of the furnaces in which the combustion space had been reduced to a decent limit, and then the amount of air pulled in would only be 7 parts. Light the furnace up, and cause the mixture of gas and air to expand to four times their volume, and the amount of air pulled in was 5 parts. So that to get the full extent of air blast without any other power than the gas, it was necessary, they found, to use at least 12 lbs. pressure with this burner. He said with this burner, because others might have a different experience. The bricks used cost about 6d. each, and were highly refractory; and they very rarely split. For efficiency, they found it was better to use arch brick. Only a very small portion came into the actual temperature zone, so that any cracking that might occur was insignificant in its effect on the furnace. The bricks could be easily taken out and replaced. There were now on the market quite satisfactory governors, which did not vary more than 3 per cent. within very wide ranges of consumption, and which were reliable in their diaphragm strength—being backed up by goldbeater's skin, for instance. Metal backers were so far not desirable. A point not referred to in the discussion was density. When it was realized that, if the density of a gas of ·45 went up to ·6, as it sometimes did with water gas in large volumes, it brought down the actual amount of gas passing through a jet to 86 cubic feet, as compared with 100 cubic feet, the effects to be got by using gas in a furnace were going to be very much less when the density went up. So that variations in density were quite as important as variations such as they had in calorific value. This was a point that should be watched. With regard to other people forging ahead, he thought they ought to recognize that coke-furnaces could be made so efficient that from an efficiency point of view gas could not compete with them, unless it was being sold at about 6d. per 1000 cubic feet. Of course, all the other advantages of gas were such that, if coke-furnaces were made as efficient as possible, gas-furnaces would still be a big advantage to manufacturers. In his opinion, a research laboratory should be connected with and installed on a gas-works, and be absolutely in close touch and alliance with the manufacturers of gas. He could not say what difficulties the makers of compensating gas-meters had come across; but he understood that the aneroid device sometimes found in these meters was not one which had a long life, in that the metal wore in its expansion properties, and consequently the aneroid required to be frequently adjusted. Wet meters had many disadvantages. The chief defect was that, unless there was a very good arrangement between the inlet and outlet cocks, they would not be able to maintain the water-level in the meter under varying consumptions and varying pressures. Another thing was that high-pressure wet meters had to be watered about twice as often as low-pressure ones. There was a distinct cutting action in connection with any escape of gas through a small orifice; and the orifice would increase in size in proportion to the pressure of the gas and the quantity passing through it. The noise of high-pressure furnaces would, he was afraid, not be done away with. It could be, and had been, reduced by building the furnaces in solid brickwork, and, instead of putting them in separate units, building a series in one big block

of brickwork masonry. This was what was being done in Birmingham. Unaccounted-for gas, he believed, was mainly due to differences in registration. He had, however, no experience of the matter himself; and in his paper he had merely quoted a statement by Mr. Cripps. Finally, he thought that gas-fitters should be certified, especially those dealing with high-pressure installations. No fitter should be allowed to have anything to do with high-pressure installation work unless he had had a satisfactory training in that direction. There was altogether too much dependent on the safety of high-pressure installations to leave anything to chance.

DIESEL OIL-ENGINE FOR INDUSTRIAL USES.

The industrial value of the Diesel oil-engine, particularly for Great Britain, was the subject of a paper by Dr. Rudolph Diesel, of Munich, submitted to the members of the Institution of Mechanical Engineers at the last ordinary meeting. As there have been many publications on the construction of the various types of this engine the author gave special attention only to questions of general importance concerning it.

The engine made its first appearance about fourteen years ago, as the result of four years of difficult experiments. When it was put into operation at the Augsburg works, engineering representatives and experts who examined it expressed the opinion, according to the author of the paper, that it gave a better utilization of heat than any known kind of heat engine. By subsequent improvements in construction and manufacture, and by increasing the sizes, the indicated efficiency of the engine was stated to reach 48 per cent., and the effective or brake efficiency in some cases 35 per cent., of the heat value of the fuel. It was consequently claimed that as the engine converts the heat of the natural fuel into work in the cylinder itself, without being subjected to any previous transforming process, and utilizes it as far as the present standard of science permits, it is the simplest, and at the same time the most economical, prime mover. These two facts, said Dr. Diesel, explain its success.

The improvements effected in constructional details, however, do not constitute the importance of the engine to the world's industry. It is claimed for it that it has broken the monopoly of coal, and solved the problem of using liquid fuel for the production of power in its simplest and most general form. It has become, for all natural liquid fuels, what the steam-engine and gas-engine are for coal, but, as its inventor submits, in a much simpler and more economical way. It has, he said, doubled the resources of mankind as regards the production of power, and has made new and hitherto unutilized products of Nature available for this purpose. It has thereby exercised a far-reaching influence on the liquid fuel industry, which is at the present time improving more rapidly than was previously conceivable.

With all this, however, said Dr. Diesel, the influence of the engine in the world's industry is not exhausted. As early as the year 1899, he utilized in it the bye-products of coal distillation and coke plants, such as tar and creosote oils, with, as he submitted, the same satisfactory results as with natural liquid fuels. But he said the quality of these fuels at that time "was generally too inferior for their use in the engine, and was, moreover, subject to continual variations." He indicated as follows the difficulties which then presented themselves: (1) Muddy deposits of solid hydrocarbons, especially naphthalene, which interfered with the working of the fuel-pumps, filled up the pipes and nozzles, and formed a hard crust at the mouths. (2) Continuous change in the quality and composition of the crude, uncleaned tar-oils, the characteristics of which were not then exactly known, even to producers. By improved methods of fractioning and refining, combined with more careful selection of the material, chemical manufacturers have succeeded in supplying fuel of constant and regular quality; and the result has been that tar and tar oils have now been definitely brought into the sphere of activity of the Diesel engine. It is consequently having an increasing influence on the industries connected with the manufacture of gas and coke, the bye-products of which have become so important for the production of power that an enormous business is connected with them. Every gas-works having an installation of modern plant, and every coke-works can now be completed by the addition of plant for the generation of electricity by the utilization of the tar produced in them.

The author gave a summary of the development of the Diesel engine, and showed illustrations of a few types marking stages in its evolution, accompanied by diagrams of the principal movements on the four-stroke and two-stroke engines. He also described his marine engines. In the remarks at the close of this section of the paper, he said it was now generally agreed that the four-stroke engine, from 5 H.P. up to 600 H.P. might be regarded as the exclusive type for stationary plants, but that it would probably not remain so very much longer, in view of the development of the two-stroke engine, more especially that of the double-acting type.

The rest of the paper was devoted to a consideration of the question of the special importance of the Diesel engine for Great Britain; and the author submitted the following facts in support of the position he took up. First of all, Great Britain is an exclusively coal-producing country; secondly, it has the largest colonial empire in the world; and, finally, it is the greatest shipping nation. Dealing with the first fact, he urged that England has the greatest interest in replacing the coal-wasting steam-engine by the more economical Diesel engine, because she can therewith effect enormous savings in coal—her most valuable treasure—and thus defer the exhaustion of the stock; and also because she can run her coal industry and the independent chemical industries on more economical lines, by utilizing the tar and tar oils in the manner indicated in the paper. Passing to the second fact, he pointed out that the transport of liquid fuels is considerably easier and more convenient than the transport of coal, more especially when tank-vessels and pipe-lines are used; and he submitted that the oil-engine is the one most suitable for the Colonies. On the third point, he ventured to predict that one of the greatest evolutions of modern industry will be connected with the development of this engine, and that Great Britain, as the greatest shipping nation of the world, will derive the utmost advantage from it.

Appended to the paper were particulars of the qualities and composition of all liquid fuels suitable for use in the Diesel engine, a specification of tar oils by the German Tar Production Trust at Essen-Ruhr (given below), and analyses of various pit-coal tars.

1.—Tar oils should not contain more than a trace of constituents insoluble in xylol. The test on this is performed as follows: 25 grammes (0·88 oz. av.) of oil are mixed with 25 cubic centimetres (1·525 cubic inch) of xylol, shaken and filtered. The filter-paper before being used is dried and weighed, and after filtration has taken place it is thoroughly washed with hot xylol. After re-drying, the weight should not be increased by more than 0·1 gramme.

2.—The water contents should not exceed 1 per cent. The testing of the water contents is made by the well-known xylol method.

3.—The residue of the coke should not exceed 3 per cent.

4.—When performing the boiling analysis, at least 60 per cent. by volume of the oil should be distilled on heating up to 300° C. The boiling and analysis should be carried out according to the rules laid down by the Trust.

5.—The minimum calorific power must not be less than 8800 calories per kilogramme. For oils of less calorific power, the purchaser has the right of deducting 2 per cent. of the net price of the delivered oil for each 100 calories below this minimum.

6.—The flash-point, as determined in an open crucible by Von Holde's method for lubricating oils, must not be below 65° C.

7.—The oil must be quite fluid at 15° C. The purchaser has not the right to reject oils on the ground that emulsions appear after five minutes stirring when the oil is cooled to 8°. Purchasers should be urged to fit their oil-storing tanks and oil-pipes with warming arrangements to re-dissolve emulsions caused by the temperature falling below 15° C.

8.—If emulsions have been caused by the cooling of the oils in the tank during transport, the purchaser must re-dissolve them by means of this apparatus. Insoluble residues may be deducted from the weight of oil supplied.

In the course of the discussion on the paper,

Mr. Dugald Clerk pointed out that the idea of compressing air alone in a cylinder, and then injecting fuel into that air in either a gaseous or a liquid state, was not a new one when Dr. Diesel first took up the work. As far back as 1887, he himself constructed a two-cycle engine in Birmingham in which air was sent into the cylinder and compressed, after which gas was forced into the cylinder and ignited. It entered the cylinder and produced a constant-pressure engine of the type, so far as thermodynamics are concerned, we are accustomed to know now as the Diesel. It was this engine that led him to take a great interest in the constant-pressure engine; and, judged from the purely thermodynamical point of view, he was bound to differ from Dr. Diesel in the figures of efficiency which had been put forward in the paper. They were too high, for the reason that in calculating the indicated power of the Diesel engine the positive diagram above compression was taken for the mean pressure. This positive diagram included, however, a certain proportion of work which was given to it by the high-pressure compressed air coming through the compressing pumps. On the Continent, Dr. Diesel and others had always considered that this was a friction loss, and should go into the mechanical efficiency. He differed from this, and considered that it should be regarded as one of the thermodynamic elements. Calculated in this way, the efficiency of the Diesel engine given in the paper as 48 per cent. would be 39 or 40 per cent., which in itself was enormously high. The usual maximum practical efficiency of the engine ranged from 29 to 32 per cent. From any good gas-engine, with compressions of about 5½, it was possible to get 30 per cent. in brake horse power of the heat given to the engine cylinder in the form of gas; and 35 per cent. could be obtained by taking a few precautions, such as putting in a little exhaust gas to prevent pre-ignition. For this reason he differed from Dr. Diesel in thinking that there was any special economy, from a thermodynamic point of view, in the Diesel engine. He would undertake to construct a gas-engine with expansion sufficiently long to give any thermal efficiency, either indicated or brake, which Dr. Diesel could do with his type of engine; and he would use the expansion type. But, of course, he would require to build a very much heavier engine than he had ever constructed. An advantage which the gas-engine had over the Diesel engine was in pressure per square inch. With cylinders

of above (say) 24 inches, Dr. Diesel had not only to provide for 500 lbs. per square inch for the compression, but to design for ordinary pre-ignition. Therefore he had to reckon for 1000 lbs., though the maximum pressure was only 500 lbs., because if the inlet-valve was stuck up, and they did not get a charge in the cylinder, and if anything went wrong so that they could not compress the mixture, unless they provided sufficient metal there would be very serious trouble. Dr. Diesel had provided enough metal in his smaller engines; but he (Mr. Clerk) did not see how it was to be done in the larger cylinders—at any rate, those above 24 inches diameter—nor did he know of any safety arrangements for getting rid of a sticking valve. The difficulties in this connection with gas-engines were great; but he thought they were greater with the Diesel engine.

Mr. Mark Robinson said there was one matter which seemed to him to be of the very greatest interest and importance. It was evidently claimed for the Diesel engine that it was not only the best where coal was scarce, but even where coal was plentiful. It was particularly claimed that better use could be made of coal by making gas from it for gas-engines, tar from it for Diesel engines, and coke and other bye-products from it for other purposes, than by burning it in a furnace under a steam-boiler. If this view was supportable and could be enforced, it was a matter of very great importance indeed. It was one to which all must give attention.

Mr. H. S. Russell complained that the paper was chiefly a record of what had been done by Continental makers, and said nothing about those in England. He reminded Dr. Diesel of the first engine of this type made in England in 1897, and still working. He admitted that the largest engine constructed by the makers of the engine referred to was 750 H.P.; but this had been tried over and over again, and found absolutely reliable. This could not be said of some of the engines mentioned in the paper. He had been informed by an official of the British Government, who had inspected all the Continental works, that makers had not got any farther than British makers, except on paper. Some people—especially municipal authorities—were too easily taken in by this boasted Continental superiority. He also claimed for British engineers the first development of the high-speed engine. Two-stroke engines and horizontal engines were not new. The former were made in England eleven years ago; and a horizontal Diesel engine was shown at the Glasgow Exhibition in 1901. He preferred the four-stroke engine. It was claimed that the weight of the two-stroke engine was less; but he knew of a case where, after an engine of this class had been made, it turned out to be just as heavy as the other. He did not believe there was any gain in either price or weight. As to the horizontal type of engine, he saw no advantage whatever, but many disadvantages, in it.

Dr. Diesel replied briefly. He agreed with Mr. Dugald Clerk in calculating the efficiency of the engine. The method he had followed was the universal one on the Continent, as it was very simple; but he was one of the few people there who disagreed with it. He also agreed that gas-engine efficiencies were now equal to those of the Diesel engine; but he reminded his audience that this was not always so. Fifteen years ago, the efficiency of the Diesel engine was twice that of the gas-engine; and he believed that the introduction of the engine had stimulated the progress of the gas-engine. The question of the two-cycle *versus* the four-cycle engine was too large a subject to enter upon then. With regard to the absence of information as to the work of British firms, he had written to most of them, but had received absolutely nothing in reply. He knew all about the first engine built in England in 1897; and probably Mr. Russell had not been in the business long enough to know that it was produced to his (Dr. Diesel's) designs. In further reply to Mr. Russell, he might state that the two-cycle engine weighed 20 per cent. less, and cost 15 per cent. less, than the four-cycle one.

The "Electrician" Electrical Trades Directory.

We have received from the "Electrician" Printing and Publishing Company, Limited, Salisbury Court, E.C., a copy of the thirtieth annual edition of the above-named Directory, which is familiarly known as the "Big Blue Book." It is published towards the end of February, and its contents (occupying upwards of 2200 pages) are corrected up to the latest possible moment. Full financial details relating to electrical joint-stock enterprise, and ample information relating to the financial side of every branch of the electrical industry, are given, including a directory of directors of electrical companies, particulars of the capital authorized and issued, the last dividends paid, latest Stock Exchange quotations, lists of the principal officials, &c.; also the principal issues of capital made and the electrical and allied companies wound up last year. The directory division contains the name and address of practically every person engaged in the electrical profession and industry throughout the United Kingdom, with their telephone numbers and telegraphic addresses; and a separate list of telegraphic addresses (alphabetically arranged) is included. A graphic survey of the engineering and electrical equipment of all the electricity supply, electric power, and electric traction undertakings of the kingdom is given in the form of a number of compact tables, the engineering and technical details furnished being very comprehensive. Two of the large tables are devoted to Colonial and Foreign undertakings of the same character. The price of the book is 15s. net, postage extra.

MIDLAND JUNIOR GAS ASSOCIATION.

Seventh Annual Meeting.

The Seventh Annual General Meeting of the Association was held on Saturday afternoon, at the Birmingham Municipal Technical School—Mr. R. J. Rogers (Birmingham), the President, in the chair.

The Report and Balance-Sheet.

The Hon. Secretary (Mr. W. J. Pickering) first read the report of the Council for the seventh session of the Association. In it, they again congratulated the members upon a successful session. The number of ordinary members, it was stated, is now 191—the highest figure so far attained, and an increase of 31 over the number on the books at the last annual general meeting. There are also 19 honorary members. It was pointed out that the Association were indebted to the President (Mr. R. J. Rogers) for his able address, and the manner in which he had discharged the duties of his office during a very busy session; to readers of papers for the maintenance of the high standard set in previous sessions; to the directors of various undertakings to which visits had been paid, for their kind invitations and hospitality; and to the Senate of the Birmingham University, and especially to Professor F. W. Burstall, M.A., Chance Professor of Engineering at the University, for the course of lectures delivered during the session on the "Production of Power from Gases." Acknowledgment was also made of the kindness of the Committee of the Birmingham Municipal Technical School in lending a room for the general meetings. The Council desired to direct attention to the state of the balance-sheet, and to the fact that copies of the 1910-11 "Transactions" of the Association, which cost 3s. each, had been distributed free of charge to the members. The report concluded: "Your Council trust that every member will actively interest himself in the Association's welfare, so that it may continue to occupy its present useful position in the gas world."

The Hon. Treasurer (Mr. G. C. Pearson) next presented the balance-sheet; and, in doing so, he said he would like to point out the splendid manner in which their honorary members had supported them, and also to express their indebtedness to the Senior Association for a donation of £5 5s. to the funds on the occasion of the joint visit of Junior Associations to Birmingham last May. They would see that the balance in hand had now fallen to £5 4s., which, however, was quite sufficient for an Association such as this. Three years ago, the balance in hand was about £33; and it was decided that the "Transactions" should be given away free—included in the subscription of 5s. It was then stated that this would probably only be able to be continued for a few years. The "Transactions" were then costing the Association 1s. 6d. a head; whereas the cost this session had come out to just over 3s. each. Of course, the reason for the increased cost was apparent; for the book had grown to twice its original size, and was illustrated to a much greater extent. He thought the Association were to be congratulated upon having such an excellent volume; it showed they were progressing. But they must look at the financial side of the question; and it was evident that if they were going to have so much printing done, and so much expense in "Transactions," an alteration would have to be made in the method of procedure. He thought it was now imperative that the "Transactions" should be charged for again. What they hoped to do was to keep up the "Transactions" and the printing account to as much as they could possibly afford (as this was the outlay from which they reaped the most benefit), and other expenditure would have to be cut down. It might possibly next session be necessary to limit the number of words and illustrations in papers; but this limit would be fixed at the maximum that they could afford.

Mr. C. Carrington Barber (Adderley Street) proposed the adoption of the report and balance-sheet; remarking that the increase of 16 per cent. in the membership was excellent.

Mr. G. M. Lewis (Windsor Street) seconded the proposition; and it was carried.

New Members of Council.

The President announced that, there being no other nominations, Messrs. B. Skidmore and A. Hancox were re-elected as members of the Council.

Proposed Alteration of Rule.

Mr. B. J. Bell (Birmingham) moved the following alteration of Rule VI.: "The subscription shall be 5s. per annum, payable in advance on election, and on each succeeding 1st of October, to the Hon. Treasurer. Members being three months in arrears with their subscriptions shall cease to be members of the Association, and shall (although not necessarily) be notified by the Hon. Secretary to that effect."

Mr. B. Skidmore (Smethwick) seconded.

Mr. P. C. Balcon (Birmingham) moved as an amendment: "That this motion be referred back to the Council for further consideration, and that it be further an instruction to the Council to consider and recommend alterations in the constitution and rules of the Association, so that the present situation be satisfactorily met, and to as far as possible prevent its recurrence; and that this meeting be adjourned for not less than six weeks, so that a sufficient notice of any recommended alterations may be given

to the members." He said that a great deal more than a simple alteration of a rule was necessary.

The HON. TREASURER and the PRESIDENT said the Council had gone into the matter carefully, and agreed that the adoption of Mr. Balcon's amendment was the best course to take.

The amendment was at once agreed to; and the meeting stood adjourned.

HIGH-PRESSURE GAS.

Mr. E. W. SMITH, M.Sc., the Chief Chemist to the Birmingham Corporation Gas Department, then read a paper on "High-Pressure Gas." This, together with a report of the subsequent discussion, will be found on pp. 890-4.

PRACTICAL USE OF GAS-LAMPS.

At the Northampton Polytechnic Institute, St. John Street, E.C., on Tuesday evening last, Mr. W. H. Y. Webber, delivered a lecture on this subject; illustrating his remarks by the aid of various types of lamps, burners, and appliances, and also by lantern slides showing different methods of illumination inside and outside shops and in streets. The audience was very small —only four students attending.

At the outset, the lecturer remarked that the whole art of the effective use of gas for lighting was based on pressure and the treatment of the air. Unlike the calorific power of any combustible, which is an absolutely fixed physical quantity, the illuminating power of gas is entirely dependent upon the treatment of the product. Therefore the so-called statutory illuminating power of gas (14 candles) is but a convention, referring to the direct comparison of the luminous intensity of the statutory burner—the argand—when passing gas at the rate of 5 cubic feet per hour, and when used to the best advantage. As a matter of fact, the most improved flat-flame gas-burner cannot, at its best, yield a better efficiency than from 2 to 2½ candle power per cubic foot hourly consumption, using so-called 14-candle gas; and using a 5-foot burner the public receive 10 or 11 instead of 14 candle gas.

The uses of the flat-flame burner as a safety light in corridors and warehouses, &c., were touched upon by the lecturer, who, describing the burner, showed that the prime necessity is to keep the flame hot, as the efficient production of light depends upon the temperature of the flame acting upon the solid particles in the air. For this reason, the tips of burners are made of non-conductors of heat. The necessity of keeping the pressure of gas at the proper point was emphasized; and it was urged that the best means to this end are to use governor-burners, types of which were explained. If the pressure of gas is too high or too low, the resulting illuminating power is much reduced. The lecturer strongly advised that the regulation of the pressure should not be left to the ordinary cock, or to the discretion of the consumer, who, in order to reduce pressure, sometimes used the regulator type of burner. This was adjusted according to the rule that as the pressure to be reduced is higher, so the difference between the sizes of two burners placed one on the other is greater.

Turning to incandescent gas-lights, the lecturer remarked that the ordinary low-pressure type works best at a pressure of 20-10ths, or 2 inches, although it will work at as low as 13-10ths. The additional pressure is needed to draw in, through the induction apertures, air to be mixed with the gas, or "bunsenized," before ignition. The total volume of air required by gas for complete combustion is a fixed quantity—being 5¼ volumes to one volume of gas. In a Welsbach burner of the upright type, it is required that 2½ volumes of air shall be sent through the injector, while a sufficient quantity of gas and air is to be passed in order to completely fill the mantle with the flame. Here again the lecturer urged the importance of the proper regulation of the pressure, so that the consumer shall not have to adjust the volume of gas by means of the cock. Having briefly alluded to the invention of the incandescent mantle, the lecturer went on to say that the mantle of to-day, so far as shape is concerned, is the same as the older ones; but the study of the combustion of air and gas had led to great improvement in the luminous intensity of the light obtained by it. At first the efficiency of the gas was only 9 candles; then it was increased to 17 and 20 candles; now it is as high as 60 candles. This is due to the fact that more air is taken in at the primary holes. With high-pressure lamps, the air is admitted in the proportion of 4·9 volumes to one volume of gas, which makes for nearly complete combustion, and therefore forms a highly explosive mixture. The reason for high-pressure lamps not exploding is that the mixture of gas and air in the tube is not explosive at the moment the gas is lighted. When this operation is performed, the air admission is low. Then a thermostat opens, and within fifteen minutes the air is being admitted to the greatest extent, and the lamp is doing full work. The high pressure of the gas serves to increase the velocity of the mixture of gas and air down the tube to the burner, and does not give the explosion wave time to fly back.

After a slight digression, in order to mention types of lamps arranged for automatic lighting, the lecturer referred to inverted burners, the great advantage of which he pointed out is the shadowless light they throw. He showed a semi-inverted lamp, which has the ordinary inverted mantle, but a horizontal or normal tube in which the mixture of gas and air is bunsenized. The advantage of this type is, he said, that the tube does not get heated, as in the regular inverted types, and consequently the admission of air is not lessened by the tube acting as a chimney, and giving an up-draught. With the regular inverted type, the access of air at the first lighting is always a little in excess of the access after it has been burning for a short time. Therefore in adjusting these lamps it is well to give a slight over-access of air at the start.

The lecturer then showed a series of lantern slides illustrating the subject dealt with.

TECHNICAL PRODUCTION OF HYDROGEN.

Dr. Lepsius, a Professor at Berlin, delivered a short time ago a lecture before the Prussian Chamber of Commerce on "The Technical Production and Use of Hydrogen," of which a summary was given recently in the "Journal für Gasbeleuchtung." He reviewed facts relating to the discovery and the physical properties of hydrogen, and then proceeded to discuss the methods now available for its technical production.

A method which is in use on a large scale at the Griesheim-Elektron works, near Frankfort, consists in the electrolysis of solution of common salt. A diaphragm of cement, which is unaffected by chlorine and alkali, is employed, and the electrodes consist of iron and carbon plates. The hydrogen is obtained as a bye-product in the production of chlorine according to the reaction:

$$2\,NaCl + H_2O = Na_2O + 2\,Cl + H_2.$$

One ton of common salt thus yields 7000 cubic feet of hydrogen. The Griesheim works, with 15,000 H.P., produce 6 tons, or 245 million cubic feet, of hydrogen per annum. The cathode chambers are hermetically closed and connected with a gasholder, from which balloons are filled. Since the first Zeppelin airship was filled with the hydrogen from this factory, hydrogen has become a regular article of commerce, and special waggons have been built for holding a series of steel cylinders charged with it, and so arranged that the whole of the cylinders are discharged through a single valve. But owing to the cost of transport of such a gas, other sources of commercial hydrogen, which could be applied locally, have been sought for. Already twenty-one technical methods have been elaborated for the production of hydrogen, of which the greater part are electrolytical. The electrolytic process of Schmidt, of Zürich, produces hydrogen at a cost of 12s. 9d. to 21s. 3d. per 1000 cubic feet in plant of a productive capacity of 21,000 cubic feet per diem.

Other methods of producing hydrogen are based on the decomposition of water by metals, such as iron. This action is reversible, and, according to Strache's process, three cylinders are used, of which the first, containing incandescent coke through which steam is passed, serves as a generator, while the second contains iron over which the water gas produced in the first is passed, and the third contains incandescent ore which is reduced by the water gas. The hydrogen of the water gas is not utilized as such; the water gas being merely used for reducing the iron oxide. The cost of hydrogen by this process is said to be 2s. 10d. to 3s. 5d. per 1000 cubic feet.

Frank has attempted to remove the carbonic oxide from water gas by cuprous chloride; but this method has not proved practicable. The Berlin Anhalt Engineering Company has erected a hydrogen plant at Tegel which depends on fractional distillation for the removal of the other gases from the hydrogen of water gas, according to a process devised by Frank, Caro, and Linde. The gas contains 97 to 97·5 per cent. of hydrogen; the balance being carbonic oxide and nitrogen. The cost per 1000 cubic feet is stated to be 3s. 5d. to 4s. 3d.

The Griesheim-Elektron works also has a process for obtaining hydrogen from water gas. The water gas, with steam at 400° to 500° C., is passed over red-hot lime, whereby calcium carbonate is formed and hydrogen liberated. The resultant gas contains 97 to 98 per cent. of hydrogen. The cost of the gas in continuous use of the plant amounts to 2s. 3d. to 2s. 10d. per 1000 cubic feet. Another method used by the same firm does not produce hydrogen so cheaply, but has the advantage that the weight of the apparatus required is very small. This method consists in preparing a mixture of oxide of mercury, alkali, and aluminium in dry powder and saturating it with water. The mixed powder costs 1s. 4d. a pound, and 1 lb. produces 16 cubic feet of hydrogen.

After mentioning other processes which similarly have the advantage of portability of the plant, but which are relatively costly, the author refers to the method of Rincker and Wolter, which is used by the Berlin Anhalt Engineering Company. It depends on passing liquid hydrocarbons, such as benzoline, petroleum, or tar, over very hot coke. Dr. W. von Oechelhaeuser has similarly arranged an apparatus of coke-retorts heated to 1200° C. in which coal gas is decarburetted, with the result that a product containing 80 to 84 per cent. of hydrogen is obtained, which is suitable for filling balloons, and can be sold at about the same price as coal gas. [See "JOURNAL," Vol. CXI., p. 512.] In addition to its use for filling balloons and airships, the author points out that there is a large field of application for hydrogen in the welding and cutting of metals, in lead soldering, and in the manufacture of artificial precious stones, as well as in many chemical industries.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Visit to Elland.

Considering the difficulties arising from the dislocation of the train services owing to the miners' strike, a notably large number of the members of the Yorkshire Association assembled at the Elland Gas-Works last Saturday. Mr. R. Porter, the Engineer and Manager, was unable to receive them, much to his disappointment (again due to unfavourable railway arrangements), and in his place his son, Mr. B. Porter, officiated, assisted by Mr. E. Garsed, the Association's Secretary, and other members of the staff. As representing Drakes Limited, of Halifax, Mr. E. Thompson was in attendance.

The members knew the reputation the works have as being deeply interesting, up-to-date, and well arranged; and those who had visited them before, under other auspices, were among the most anxious to be present on this occasion. These were among the first of the medium-sized works to instal inclined retorts and to be equipped with labour-saving machinery. Until 1901, the carbonizing plant consisted of eight beds of eight single retorts, generator fired, and provided with West's manual machines. In the year named, a new retort-house was erected as a continuation of the old house, and in this was put an installation of inclined retorts—six beds of eight; the work being done by Messrs. Drakes. The old house, with its bench of horizontal retorts, is still standing, though it has never since been used, and is marked for early dismantling.

Special interest had centred round the present visit of the Association, inasmuch as news had been circulated among the members that a setting of inclined chambers had been erected, and disappointment was felt that these were not in operation. This was partly due to the extreme inopportuneness of the present time for carbonizing experiments, when every pound of coal and coke has to be made to do its utmost, and when economy and retrenchment are imperative. Messrs. Drakes have adapted one of the inclined settings, replacing eight of the usual type of retorts by three chambers set side by side, each 3 ft. 6 in. by 1 ft. 6 in., and nearly 21 feet long. The furnace and regenerator are identical with their usual type as seen in the adjoining settings. The chambers have been in operation for a short time; but, being more or less an experimental setting, their further employment is deferred till the present period of strain is past, and the summer conditions have arrived, when their performance can be better and more exactly gauged. They will then have to compete with settings on each side of them yielding 135,000 cubic feet of gas per day, and selling 12½ cwt. of coke per ton of coal carbonized.

All coal comes by canal, and, unless it is passed to the stores and then subsequently used, does not undergo any manual handling till it is wheeled out as coke. A bucket elevator, supported on a girder, can be advanced from within the building till it is over the barge, and then lowered. This delivers coal on to a band conveyor, and from this it passes to a Zimmer conveyor which can discharge it either into the stores or the breaker pit. Special attention was paid to the ingenious way in which the slack of the belt conveyor is taken up when the elevator is withdrawn within the walls of the building. The crusher supplies the coal to a Hunt gravity bucket combined elevator and conveyor; this being the first of the kind installed in this country. Each bucket carries about 1 cwt. of coal, and is filled by the aid of a band of shoots which travel in unison with the conveyor—directing the coal into the buckets without letting any drop between them or among the chains and wheels. From the basement this conveyor travels 65 feet vertically to the roof, then horizontally over the coal-bunkers, into any of which the buckets can be discharged. A cam on the bucket side catches an adjusted lever, tilts the bucket, and discharges its contents. The empty bucket then returns to its natural position by its own gravity. After traversing the full length of the bunkers, the empty buckets descend to just below the charging-floor level, along under it horizontally for some way, and then down again vertically to the breaker pit. The overhead hoppers hold 36 hours' maximum supply.

Over the coal-stores is a large elevated tank of 500 tons capacity, divided into three compartments, for tar, liquor, and water—the last being pumped up from the River Calder adjoining. The tar and liquor can be delivered into boats on the canal below by the simple attachment of a hose and the turning of a valve. Of recent years, the liquor has been converted into sulphate of ammonia on the gas-works; one of Walker's plants, with Taylor's solid-lead saturators, having been installed.

The Grid-Works of Messrs. Walter Spencer and Sons.

The visitors afterwards walked some half-mile to the works of the above-named firm, the head of which—Mr. W. Spencer, J.P., who is Chairman of the Elland District Council—was in waiting to be the chief guide to the party. The works are conveniently situated on the high road, about half-a-mile from Elland Station, with the canal along their other side. The timber is all brought to the works by boat from Hull; and very large stocks were in evidence. Few visits arranged by the Association have proved as novel and of such absorbing interest to the members as this one. Most of them had never before seen how purifier grids are made; and they were glad to have such a common and familiar piece of gas-works apparatus as a grid assume a new meaning and excite new interest.

The works are of large size, and have been several times extended. Many of the machines have been built to Mr. Spencer's own special designs; and they evidenced much ingenuity and labour-saving resourcefulness. Mr. Spencer boasts that from the first handling of a log to the finished grid they have no need to measure or set out their work. Each machine is meant to perform a special duty; and having been once adjusted, its pegs and pins do any necessary measurement, &c. Each is placed so that the stages of manufacture follow one another with the least expenditure of labour in carrying material about; and delight and amusement mingled in the comments made on the ingenious little devices for minimizing labour, and making the wood travel along and stack itself in some cases. All the machines were set to work, so that if members did not exactly see wood go in as a tree and come out as a set of "hurdle" grids, they did see each separate stage of manufacture carried out.

The ordinary grids and the hurdle grids for which the firm have secured so widespread a fame are made on separate floors of the buildings, and each was watched through all its stages. Each grid passes through at least seven machines before it is completed. A set of hurdle grids had been placed in position as in a purifier, and Mr. Spencer described how they work. He called attention to the fact that each bar is exactly midway between two bars of the row above it; and it is the same with regard to the next row below. Hence, in filling the box, the oxide has not a direct fall, and cannot get more tightly compressed in one part than in another. Each bar does its due share in holding up the oxide, which is thus "held lightly," while the gas has an even distribution and an even speed, though, on looking into a box awaiting filling, there seemed to be a lot of wood, yet more oxide could actually be got into a box so fitted than if horizontal grids were used, as no free space between the tiers is necessary.

A modification, in which the grids slope in opposite directions from a central wedge-shaped support, was shown; and its two great uses pointed out. In the first place, it allows an ordinary box to be emptied on two sides simultaneously; and, secondly, it is specially intended for use in Green's purifiers—the wedge pieces being placed under the gangways.

Specially constructed wood-filled sectors of a rotary washer-scrubber were shown, as well as the particular form of grid for filling scrubbers; and it was explained how these are placed so as to give to the gas a spiral travel instead of a due vertical one.

The ingenuity of machine construction and of machine placing and arrangement so facilitate manufacture, that a huge output is possible from a moderate-sized works. Grids, especially the hurdle ones, go from Elland to all parts of the world; and a portion of a consignment for Australia was seen packed ready for export. To save freight, the grids are only put together on their arrival, and are very compactly arranged for shipment. Last year, one consignment of these grids for Sydney was for eight boxes, 40 feet square. Only second in interest to the ingenuity of machine construction shown was the wonderful economy in the wood used—in fact, everything seemed to be utilized on the spot, except sawdust and shavings.

It was pointed out finally that no nails or bolts or any iron-work is used in the hurdle grids; the bars being tightened in their places by wooden wedges. In the older horizontal type, iron bolts and nuts were, of course, necessary; but the latter were countersunk, and covered with wooden plugs, so that corrosion of the metal should not shorten the life of the grids.

A cordial vote of thanks was accorded to Mr. Spencer and his sons, on the proposition of Mr. Scholefield, seconded by Mr. C. T. B. Roper, and responded to by Mr. Spencer, who expressed his great pleasure in meeting the members, and in having the opportunity of showing them what was perhaps not quite familiar to all of them.

The company then returned to Elland for tea, which had been kindly provided by Mr. R. Porter. After the repast, the thanks of the members were expressed by the President and Mr. M'Nab; and Mr. B. Porter replied on behalf of his father.

Liquefied Illuminating Gas.—A patent has been taken out for France by the German Blau Gas Company. According to an abstract of the specification in the "Journal of the Society of Chemical Industry," the gas is compressed at the ordinary temperature into a reservoir, and the part which is not liquefied passes through a refrigerating column, whereby a further portion is liquefied and mixes with the liquid in the reservoir. The temperature of the liquefied gas in the reservoir must not be allowed to fall below that of the atmosphere, otherwise part of the dissolved permanent gas will be liberated in the cylinders in which the liquid is stored for use, and these will not safely take the full charge of liquid. The liquefied gas in the reservoir is therefore kept at normal temperature by means of a coil through which the compressed crude gas is passed; the liquid condensed in this coil being added to that contained in the reservoir, which is provided in the upper part with baffle-plates forming a rectifying column. The cooling of the compressed gas is effected in stages; and the liquid separated at different temperatures is added at several points in the height of the column. Part of the liquefied gas is rapidly evaporated and used to cool the refrigerators, and is returned to the compressors.

PROGRESS OF THE TIVERTON GAS-WORKS.

On the occasion of the recent annual meeting of the members of the South-West of England Association of Gas Managers at Tiverton, Mr. CLARK JEFFERY, the Gas Manager, read a paper in the course of which he gave the following account of the progress of the gas undertaking since its acquisition by the Corporation.

INTRODUCTORY STATISTICS.

Tiverton is a town with just over 10,000 population. It was about this figure when the works were purchased in the year 1895; and I believe this had been the population for a considerable time previous. The works were purchased from Messrs. Heathcoat and Co., lace manufacturers, of Tiverton; and I think gas was made at one time on a site at the factory. The purchase price was, in round figures, £20,000, including all expenses. I do not consider this was an excessive figure; and, under the present circumstances, the inhabitants have every reason to shake hands with themselves over the bargain then made. At the same time, for seven or eight years the concern was not looked on with favour, and a good many people thought it a "white elephant;" and certain steps were taken towards installing the electric light. I am glad for Tiverton that this movement was unsuccessful, or they would then have had two "white elephants."

When the first financial year ended (March 31, 1896), the quantity of coal carbonized was 3165 tons; gas made, 29,674,000 cubic feet, or 9376 cubic feet per ton; gas sold, 26,640,000 cubic feet; unaccounted-for gas 10 per cent.; number of cookers in use, 92. The maximum pressure kept on at the works for seven or eight years was between 24-10ths and 25-10ths, and at midnight between 13-10ths and 14-10ths; so that if pressure has anything to do with unaccounted-for gas, it should have been fairly low. Complaints, I believe, working with this pressure, were rather numerous. Five years after this (1901), there was a little loss of £136 on the works. The make of gas was 28,958,000 cubic feet, or a reduction of 715,000 cubic feet on the first year's working; but the sales had gone up by 907,500 cubic feet. Again, in 1903, 3604 tons of coal were used, with a make of 31,278,000 cubic feet, or 8860 cubic feet per ton, and a loss on the works of £400. The number of cookers in use then was 341.

PROGRESS OF THE GAS UNDERTAKING.

I had the honour to be appointed Manager by the Corporation in 1904; and at the end of my first year, or part of a year, there was a loss on the concern of £514. This being my first experience of an adverse balance, it fairly got my "monkey" up. This was on March 31, 1905, when the coal carbonized was 3047 tons; gas made, 30,839,100 cubic feet, or 10,121 cubic feet per ton; gas sold, 28,936,000 cubic feet, or 6 per cent. unaccounted for. The capital at this time (ten years after the first balance-sheet) stood at about £26,700; and the gross profits were only £1437, while the standing charges were £1951. So that it would seem that the capital for the first ten years went up a good deal out of proportion to the growth and success of the undertaking. At March 31, 1906, the coal carbonized was 3074 tons; gas made, 34,646,100 cubic feet, or 11,271 cubic feet per ton; gas sold, 32,451,300 cubic feet; gas unaccounted for, about 6½ per cent. The gross profit was £2640, the standing charges were £2027; and in the same year we paid into the district fund account, to help pay off the cost of an Electric Lighting Order, £613. I might mention that we had done little on the works up to this time, and all the old plant was still in use, including direct-fired settings of retorts, as most of my time had been taken up on the district. In the year 1910, the coal carbonized was 3609 tons; gas made, 41,993,700 cubic feet, or 11,543 cubic feet per ton; gas sold, 39,993,700 cubic feet; gas unaccounted for, about 4¼ per cent. The gross profit was £3089, the standing charges were £2540, and we paid into the district fund account again that year £400, and placed £148 to our own reserve. For the year ending March 31, 1911, 3921 tons of coal were carbonized and 45,116,600 cubic feet of gas made, or 11,506 cubic feet per ton; gas sold, 42,180,500 cubic feet; gas unaccounted for, 6½ per cent. The gross profits were £2861, standing charges £2683; and there was placed to reserve, £178. At this time the capital stood at £36,536; so that the capital has gone up since 1905, owing, of course, to the whole of our extensions and improvements both within and outside the works and the rapid growth of business, by £9836; but for this we have nearly all new plant on the works, including cookers, meters, mains and services, and so on. This vast amount of work could not have been done, as you will know, for this sum had not a good deal been carried out from revenue each year. The total indebtedness on the works at March 31, 1911, stood at £18,340. In the years 1905 and 1906, 3604 tons of screened coal were carbonized to manufacture 31,278,000 cubic feet of gas; and for the year ended March 31, 1911, 3921 tons of through coal were used to manufacture 45,116,600 cubic feet of gas, or an increase of 13,841,600 feet with an increase of only 317 tons in coal consumption.

Trade was not extra brisk in Tiverton during the past year; but the consumption of gas is slightly on the increase. The make, up to March 31, 1912, will be 46 million cubic feet, or an advance of nearly a million on last year. Since the purchase of the works, there has been an increase 16,326,000 cubic feet. For the first ten years, the total increase was just over a million, and for the last seven years just over 15 millions; and, seeing that the population has not grown, I think we have done fairly well, and the extra capital has been well and judiciously laid out. We had on our books at the end of 1906, 621 ordinary and 455 prepayment consumers—total, 1076. At present they stand at 595 ordinary and 965 prepayment—total, 1560. The increase since I came here has been about 600 consumers. The number of cooking-stoves in use to date is 1015, against 341 in 1904. When the works were purchased, the price of gas for all purposes was 3s. 11d.; in 1901-2, it was 4s. 3d. for lighting and 3s. 10d. for cooking; in 1906, it was 4s. 1d. for lighting, and 3s. 8d. for cooking; at Midsummer, 1906, it was reduced to 3s. 8d. for all purposes; and at Midsummer, 1907, to 3s. 6d., which is the present price, with the exception of engines, which are supplied at 3s. We commenced fixing brackets for slot consumers in 1906; and since that time 1665 have been installed. We do everything free for slot consumers, and supply them with meter, stove, and three lights or a boiling-ring. They get 20 cubic feet of gas for 1d., or, if a better cooker is required, we charge rent and give 22 feet of gas. Both slot and ordinary consumers get every possible attention; and the district is watched very closely.

During the last few years we have improved the public lighting, and installed nearly all new lanterns, fitted with No. 4 Kern burners and Sugg's No. 4, with a few inverted burners of Messrs. Willey and Co.'s make; and out of about 247 public lamps which used to have flat-flame burners we have 213 incandescent. This kind of lighting has improved our streets considerably; but it is costing the town about £150 per annum less. Nearly all our meters are either new or have been repaired during the last five or six years; and a very few old services are in use under the ground. In the year 1909, we laid 1280 yards of 5-inch Mannesmann tube, caulked with lead wool. The number of services off this main is 171; and 135 of these are prepayment. In 1910, in place of an 8-inch trunk main from the works, we laid a 12-inch cast-iron one for about 400 yards, caulked with lead wool.

PARTICULARS OF THE GAS-WORKS—CARBONIZING PLANT.

With regard to the works [which the members had inspected], they have been turned inside out. It has not been a very easy site to erect plant upon, as we touch water at about 3 ft. 9 in. I may say that during the last few years nearly every foot of ground on the works has been excavated, either for pipes or plant. The coal-store has been made more convenient, and in one corner two steam-boilers have been put in to generate steam for engines, pumps, sulphate plant, and charging-machine. One is of the Thompson Cornish type, 15 feet long and 5 feet diameter, provided with all up-to-date fittings and Meldrum's forced-draught furnace for burning breeze. The second is a small vertical type boiler, and erected as a stand-by. In the retort-house, all the carbonizing plant has been renewed, and all under the regenerator principle. There are two separate stacks, with three arches in each—three with six retorts in each, 21 in. by 15 in. and 10 ft. long, ⌂ section, and three with nine retorts in each of the same dimensions, all fitted with self-sealing mouthpieces, and 6-inch ascension and bridge pipes. Each set has a separate wrought-iron hydraulic main. A separate 3-inch flushing-valve is provided to each section, and a 1½-inch liquor-pipe from an overhead tank is connected to each for filling-in after flushing. There are a 4-inch tar-main and a 9-inch foul main. The hydraulic and other connections are carried by 6 in. by 5 in. steel joists, secured by cleets to the 8 in. by 5 in. front and back stays. The concrete over the whole area of the retort-stacks and subways is 2 ft. 6 in. thick. The retaining walls up to the floor level are 2 ft. 3 in. thick. The retort power is equal to 350,000 cubic feet per day, and the maximum daily make is about 200,000 cubic feet. Messrs. Gibbons Bros., of Dudley, were the Contractors for the work. The charging is done by one of Messrs. Biggs, Wall, and Co.'s "Rapid" power machines; there is also a manual machine fixed upon the same rails, ready in case of a temporary breakdown of the power machine.

ENGINES AND EXHAUSTERS.

The engine-room has been made the best use of, since we have three engines, four pumps, and two exhausters fixed in it. The engines for driving the exhausters, pumps, washer-scrubber, and coke breaker are both 8 H.P.; one being a steam and the other a gas engine. Both the exhausters are three-blade, by Messrs. George Waller and Son—one of 15,000 cubic feet and the other of 20,000 cubic feet per hour. Cleaning-doors, plugs, and T-pieces have been provided both above and under ground in place of bends, so that no time shall be lost in making future connections or cleaning-out apparatus. Steam-pipes and water-pipes with various tees have been carried all over the works; so so that, should it be required, temporary connections could be made in a very few minutes.

WASHERS AND PURIFIERS.

There is one of Cockey's washers, which is used principally as a tar-extractor. The cooling or condensing plant runs round the full extent of the buildings from the coal-shed to the engine-room; and it is fixed by brackets to the walls. The washer-scrubber is by Messrs. Holmes, and is capable of dealing with half-a-million cubic feet of gas per day. The sulphate plant, in the same house, is by Messrs. Biggs, Wall, and Co. It is an exceedingly efficient and up-to-date plant, and is capable of making a ton of sulphate per day. All liquid products from various parts of the works are raised by steam or belt-driven pumps from an underground cast-iron tank, 29 ft. by 10 ft. and 5 ft. deep, to an overhead tank in two sections, one for tar and the other for liquor. This

tank is 21 ft. by 13 ft. and 5 ft. 6 in. deep, fixed on six cast-iron columns 12 ft. high, and steel joists 10 in. by 5 in. and 12 in. by 5 in. All liquor is run from this tank by gravitation for whatever purpose it is required. The purifiers are four in number, 15 feet square and 5 feet deep, with rubber joints under the covers and suitable travelling hoist. Two boxes are filled with Spencer's hurdle grids, and two with ordinary grids—all with 12-inch connections and Pickering valves. The foundations are built solid with stone and brick set in cement mortar, and are 62 feet long by 16 feet wide, and 1 ft. 6 in. deep. The shed covering the purifiers is 70 feet long and 25 feet wide. The covering consists of 20 B.W.G. galvanized sheeting, carried on 8 in. by 6 in. rolled-steel joists and uprights. The oxide-shed adjoining is composed of the same material, only that it is 55 feet long and 25 feet wide. The purifiers were erected by Messrs. Willey and Co., and the sheds by Messrs. Newton, Chambers, and Co.

Meters and Governors.

The station meter, governor, and valve-room work was carried out by Messrs. Willey and Co. The meter is a square one, with a capacity of 15,000 cubic feet per hour. The governor is a 12-inch, and water loading, of the Simpson type. All the valves for the gasholder inlets and outlets are connected to a 15-inch diameter collecting chamber, so that all the holders can be controlled from one point.

Gasholders.

There are three gasholders of modern design and construction—two of 50,000 cubic feet each, and one of 112,000 cubic feet; the latter being the last new one, and erected by Messrs. Willey and Co. This holder is two-lift—the inner lift being 60 feet in diameter and 20 feet deep, and the outer one 62 feet and 20 feet; and the steel tank is 63 ft. 6 in. by 20 ft. The tank contains 390,000 gallons of water, and with the ironwork (185 tons) throws a total weight on the foundations of 2000 tons. In the construction of this holder 140,000 rivets were used. The pipes and bends inside the tank as far as the syphons are 15-inch; and, with a few exceptions, the rest of the mains on the works are 12-inch.

The Works as an Asset.

With the exception of the Cockey washer, the small exhauster, the gas-engine, and the two small holders, all the plant has been erected during the last five years; and I think you will agree that we have very good value for our money, and gas-works capable of meeting the demands put upon them for some time, and that we are in fighting trim for anything and anybody that cares to fire the first shot. I think I can safely say that if the Tiverton Gas-Works belonged to a private company to-day, the Corporation could not purchase them for much less than £70,000. I could not close these few remarks without telling you how delightfully well my Chairman, the Gas Committee, and the Corporation as a body, have stood by me since I came to Tiverton. They take a keen delight in the gas-works, and are the most businesslike and sensible set of gentlemen I have ever had the pleasure of working under, because they interest themselves in everything in connection with the Gas Department. They appointed me Manager, and let me be Manager.

GAS v. ELECTRICITY FOR POWER.

The subject of "The Application of Gas-Engines to Industrial Purposes," which was introduced by Mr. Alan Chorlton (of Messrs. Mather and Platt, Manchester) at a meeting of the Sheffield Society of Engineers and Metallurgists on Monday last week, was a strong plea for the engine with which the lecturer is associated; and he illustrated his remarks by many examples of working and comparative figures of cost.

In the course of his lecture, Mr. Chorlton pointed out that in the last few years gas-engines had been made in increasing sizes up to 6000 H.P., and the reliability had been brought up to the standard of the once omnipotent steam-engine. The invention of the producer, its progress and improvement, had extended the field of the gas-engine through the greatly increased economies that were made possible. The steady and continuous improvement in the manufacture of ordinary gas, of which no better example was shown than in Sheffield, enabled it to be supplied at such a rate as to react against the producer; so that the economies to be obtained alone by this means were now equally realizable, when too great powers were not dealt with, by town gas, when sold at the extremely low rates of the Company who supplied Sheffield, with the additional advantage of the saving of extra capital cost, space occupied, &c., entailed by producer plant. Though ordinary and producer gas had their economical sphere, the prospect of using waste gases from coke-ovens and blast-furnaces was still more alluring from the economical point of view; and there was little doubt that for large engines, 500 H.P. and upwards, the greatest field at the present time was in the use of these waste gases. Though the advantages to be gained were so great, the progress to date in this country was nothing like what one would expect, and certainly compared very unfavourably with that made on the Continent.

The lecturer gave a table of the comparative cost of ordinary gas and electricity for small powers—showing the approximate cost of the former, at 11d. per 1000 cubic feet, to be 0·35d. per B.H.P. hour, and of the latter, at 0·9d. per unit, 0·84d. per B.H.P. hour. Another table showed the results which could be obtained with a bituminous suction producer and a vertical enclosed gas-engine and dynamo working on a continuous load as for electric furnaces. The plant was a gas-generating station for 525 B.H.P., or 350 kilowatts. The capital cost was £4740, and the running cost £1535 per annum. As an interesting comparison, the results obtained by a Sheffield firm using the Corporation's electric current at 0·6d. per unit were given. In this case the capital cost of a 350-kilowatt motor generator set was £1530, and the running cost £7389 per annum. Allowing for interest and depreciation at 6¼ per cent., the gas plant showed a saving of £5653 per annum; or, if the charges named were 10 per cent., the saving was £5533. Mr. Chorlton also quoted from a table given to him by Mr. Hanbury Thomas, the Managing-Director of the Sheffield Gas Company, comparing (from actual practice) the costs of running a steam-engine, an electric motor, and a gas-engine operated on town gas. An old steam-engine was replaced by electric-motors, which, after about six months' trial, were taken out, and a gas-engine installed. The actual comparative running costs per annum were at the following rates: Steam-engine, £81; electric-motor, £62; gas-engine, £32.

Mr. G. Blake Walker, who presided, quoted figures showing the superiority of a gas-engine plant to a modern steam-turbine plant. He remarked that, low as the price of Sheffield gas was, it was a good deal higher than at some places abroad, where gas was being sold in bulk for power purposes. There were, therefore, great possibilities of getting more power for less money.

Professor Ripper said there was no centre in England to which a cheap power supply was so important as it was to Sheffield. There were no more wasteful power plants to be found anywhere than in the small works using the old-fashioned steam-engine and boiler. When, however, they came to large plants running into 3000 H.P., they must not go away with the idea that the proper thing was to get rid of steam at the earliest possible moment, and introduce a gas-engine plant. The gas-engine was steadily winning its way; but he advised those who were responsible for large power plants not to be in a hurry.

Mr. S. E. Fedden, the Manager of the electricity undertaking of the Corporation, described as extraordinary and misleading the table showing a saving of £5653 by the use of gas as against electricity. He said he did not know of such a gas installation, and, as to the Sheffield firm mentioned, the actual cost of a year's working of the furnaces was more like £2000. It was impossible, therefore, to get a saving of £5600. He submitted that the lecturer had taken an impossible load-factor. He pointed out that in Birmingham, which was the centre of gas-producer plants, the electric-motor was going ahead by leaps and bounds, though the charges for power were 25 per cent. higher than in Sheffield. Why had Sheffield manufacturers put in motors to the extent of 20,000 H.P. in the last few years, and why had the Electricity Department orders on hand for 3000 to 4000 H.P. more? Because it suited their business interests, whatever the lecturer might say. Referring to the case quoted from Mr. Hanbury Thomas's table, he said it was an exceptional one; and he could find many others to bring against it. Only that morning he had been told by a manufacturer who some three years ago removed his gas-engines and put in electric-motors that he had not since shut-down for a quarter-of-an-hour, whereas before he had to stop for half-a-day or a day every week, because of his old gas-engine breaking down. When asked why he did not put in a new and up-to-date one, he said he had had enough of gas-engines.

Mr. Hanbury Thomas promptly rose at this point, and related what a friend had told him. He had gas-engines and wanted electric power, so he had a motor put in by the Corporation officials; and it was costing him at least three times as much as his gas-engine.

There was not time for much discussion, as Mr. Chorlton had to leave Sheffield by an early train.

The "Rex" Gas-Iron.

Miss Parkyn, who is assisting Miss Helen Edden at the cookery demonstrations at the Royal Agricultural Hall, in connection with the Smoke Abatement Exhibition, has invented a new gas-iron, which has commendable features about it. A complaint that has been heard on various occasions is that gas-irons are, as a rule, weighty; but this one has the merit of being much lighter. The "Rex," too, is very economical in gas consumption; a cubic foot an hour being all that is required. Another virtue is that it will not light-back. These are points that alone should make the "Rex" a favourite in the household; and, though we cannot speak of the iron from the practical point of view, the fact that it has been designed by a lady who knows what is required in this line makes us anticipate that there will be a good demand for it. Anyway, gas authorities can easily put the iron on trial; and, if satisfactory, a prominent place in the show-room should be found for it. There should be a big business to be done in gas-irons. Let us not forget what Mr. E. Korting was telling us last week in his article on "The Women's Exhibition in Berlin," that, in the Berlin district of the Imperial Continental Gas Association, from 30,000 to 40,000 gas-irons have been sold in a period of only twelve months. Every gas-iron that is used is thus equal to a gas consumer.

REGISTER OF PATENTS.

Prepayment Gas-Meters.

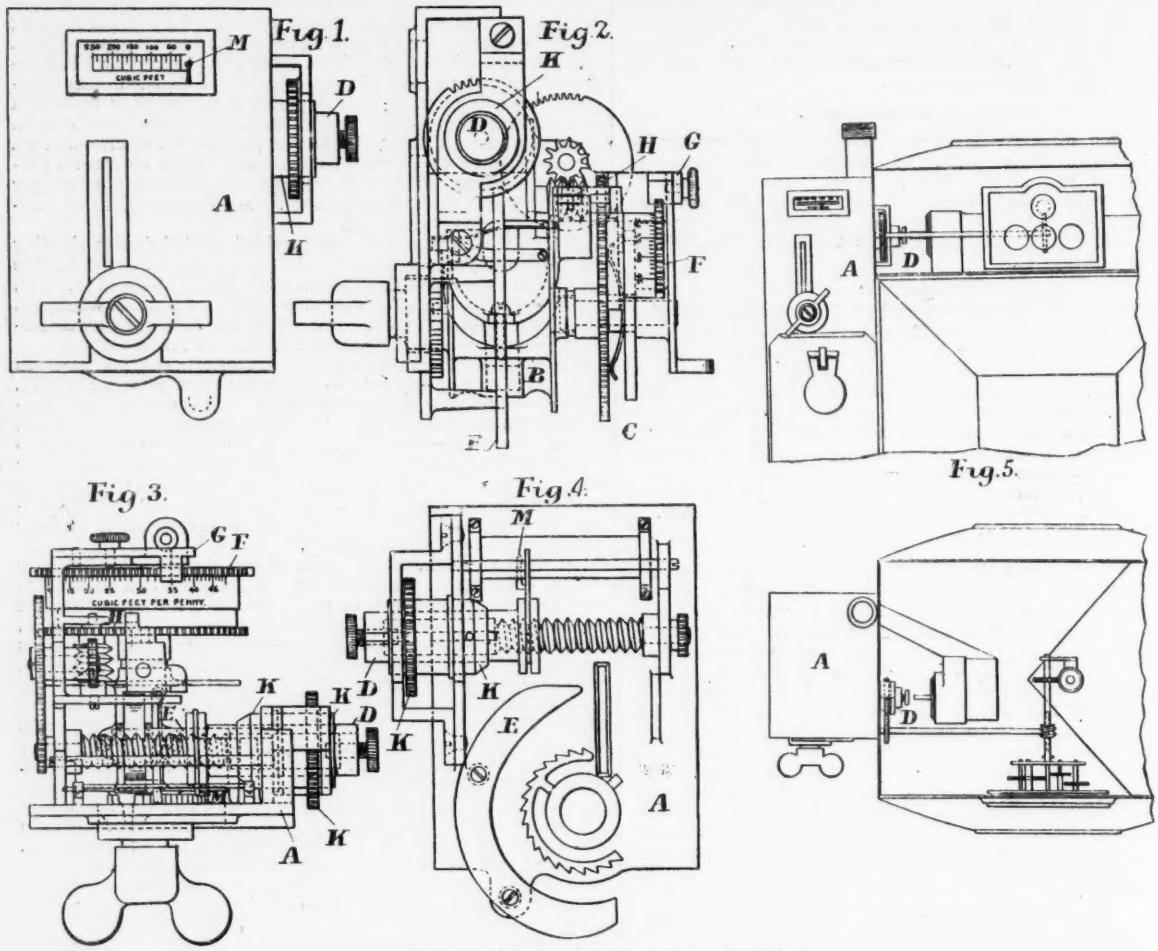
R. Laidlaw and Son (Edinburgh), Limited, and Mackenzie, J., of Edinburgh.

No. 3921; Feb. 16, 1911.

This invention has for its object to provide means for varying the quantity of gas supplied upon a coin being placed in the meter.

Fig. 1 is a front view of the attachment; fig. 2, a side view; fig. 3, a plan; and fig. 4, a back view (with the coin-pocket, feed-wheel, and toothed quadrant removed). Fig. 5 shows the application of the improvements to a meter.

In a casing A (usually at the side of the meter) is an aperture for a coin, which passes to a pocket B within the casing. Through the medium of the coin, and by the action of turning the coin-pocket round, a feed-wheel C is turned so as to affect the movement of a backward-and-forward moving plunger D governing a valve controlling the supply of gas from the main to the house. The wheel C is caused to partially rotate, according to the varying number of cubic feet of gas supplied for the coin.



Laidlaw and Mackenzie's Prepayment Gas-Meters.

The coin-pocket is secured to an axle, which can be rotated by means of a wing nut at the outside of the casing; and within the pocket is an arm fitting into the coin-pocket, and formed with a cavity on which rests a portion of the periphery of the coin. The arm is urged away from the axis of the pocket by a spring which fits into a recess of the pocket, and is kept from being entirely urged out of the pocket by stop-pins at the sides of the pocket. At the rear side of the arm is a small spring plunger, on the under side of which is a right-angle projection; the plunger being drawn towards the axis of the pocket by a spiral spring fitting within a projection of the arm. On the edge of the arm, in proximity with the slot in which the coin rests, is a spring-controlled pawl, which is moved in a direction to or from the axis of the pocket simultaneously and along with the arm. On the inside of the casement is a segmental toothed rack, with which the pawl on the edge of the arm co-operates. Partly surrounding the arm and pocket is a plain segment E, the inner edge of which, for a given distance, is concentric with the axis of the pocket; but at the beginning of the motion of rotation imparted to the pocket—in a clockwise direction—the edge of the plain segment departs from its concentric form and describes an arc larger than that of the other portion of the plain segment.

One portion of the edge of the coin rests against the pocket formation of the arm, while the opposite edge rests against the inner edge of the segment E. Now as the pocket with its arm is given a motion of partial rotation, the inner circle of the plain segment, becoming smaller, gradually forces the coin towards the axis of the pocket, and in so doing it depresses the arm, and the pawl is thus in the position for engaging with the quadrantal rack at the back of the casing. It glides over the teeth when the pocket is rotated in one direction; but if it is attempted to move the pocket in an opposite direction, the toothed rack and the pawl engage and prevent any rotation until the coin has been deposited in the coin receptacle provided for the purpose. At this stage the arm is free to rise, and therefore carries with it the pawl, which does not then engage with the quadrantal toothed wheel. The point where the coin is inserted, and where it is released from the pocket and drops into the cash-box, does not change, no matter what quantity of gas is supplied for the coin.

At the rear end of the pocket is a toothed wheel C, each tooth of which represents a foot of gas. The wheel is capable of being moved on the axle of the pocket, but it is held frictionally tight by means of a spring. At the rear of the wheel is a quadrantal toothed wheel portion F, which is also capable of riding on the axle of the pocket and being also held frictionally tight by means of the spring. This quadrantal toothed portion is provided with a number of teeth corresponding in pitch with the wheel C. At the one side of the quadrantal toothed portion is a shroud (of smaller diameter than the toothed wheel), with markings to indicate feet of gas. At one side of the shroud another shroud of smaller diameter is provided; both shrouds being formed or carried along with the quadrantal toothed portion F. The position of the rack is determined in a set manner by means of a fixed pawl G, which is inserted in any one of the teeth of the rack so as to determine the position—the fixed pawl being rendered adjustable by a thumb-screw connection.

The depending or right angle projection of the arm, already referred to, engages with the smaller shroud of the quadrantal toothed wheel F, when the arm is depressed within the pocket by the action of the plain guide E and coin. Now when this action takes place and the depending projection is forced against the shroud, the plunger of the arm is forced away—that is to say, outwardly from the pocket—whereby the tooth on the under side of the plunger is prevented from engaging with the toothed feed-wheel C. But when the pocket with the arm is moved sufficiently far, the depending portion of the plunger gets free of the shroud, and the spring of the plunger pulls inwardly the plunger until its tooth engages with the toothed feed-wheel C. The pocket is still turned round to its extent, and the tooth of the plunger is only feeding *pro ratâ* to the amount of the rotation—that is to say, the tooth of the arm is caused to come into contact with the teeth of the feed-wheel C sooner or later, according to the quantity of gas supplied for the coin.

Working in conjunction with the wheel C is a pinion H, having a worm engaging with the worm-wheel secured to a spindle carrying a larger toothed wheel, in turn gearing with a toothed pinion secured to a screw spindle which effects the traversing of the sleeve D in a forward direction, and which sleeve passes through another sleeve K carrying a toothed wheel. The end of the sleeve D is provided with

an adjustable plunger, which engages with the stem of the gas-valve shown in fig. 5 and effects its opening when the plunger recedes from it, as described in patent No. 3148 of 1904.

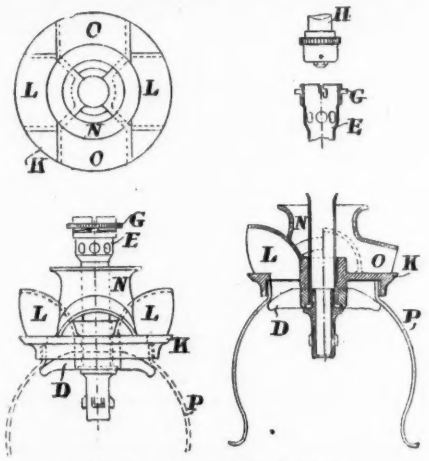
As the gas is consumed, the index mechanism of the meter, being geared to the toothed wheel, carries on the fixed sleeve K, and the meter mechanism thus imparts rotation to the toothed wheel and causes the traversing sleeve D, with its plunger, to approach the gas-valve, thereby closing it. In conjunction with the traversing sleeve is an indicator finger M (given reciprocating motion from the sleeve D), which shows, by means of a dial, the amount of gas paid for but not consumed.

Inverted Incandescent Gas-Burners.

DUNPHY, A. L., of the South Metropolitan Gas Company, East Greenwich.

No. 3931 ; Feb. 16, 1911.

The object of this invention is the construction of an inverted gas-burner without metal fittings and screws, so as to receive and hold securely the globe The component parts of the burner are : (1) A nozzle having pockets to receive the lugs of the mantle ring ; (2) a tripod, although of itself not new, on which the globe is hung ; (3) a movable crown with concentric lip around its edge, for securing the globe, and having ducts for the burnt gas and a cap with ducts for supplying fresh air to the bunsen, all of fire-clay or other refractory material ; (4) a central bunsen tube of metal or fire-clay with a flange at its lower end for supporting the tripod, and terminating at the top with a bayonet joint and slip ring for attaching to the fitting.



Dunphy's Inverted Gas-Burner.

The burner consists of a nozzle of fire-clay screwed into a tube of metal or fire-clay having at its lower end a flange on which the tripod D, of fireclay, rests, and at its upper end a bunsen attachment E combined with a bayonet joint and slip ring G for fixing to the gas-pipe H. The crown K (of fire-clay), with its foul-air ducts L and concentric lip, revolves on the gas supply tube, and can be raised or lowered as required ; a cap N (of fire-clay) fitting loosely on, or forming part of, the crown, and having ducts O for conveying fresh air to the bunsen E. The bayonet joint consists of a taper plug screwed to the terminal gas-pipe H, and having two pins diametrically opposite to each other, with a shell or sleeve S attached at its lower end to the bunsen fitting E, and at its top end fitted to receive the plug. The sleeve has two cranked pathways (cut diametrically opposite) to admit the pins ; and the slip ring G, which is mounted concentrically on the sleeve, has two covered openings diametrically opposite to allow the pins to pass.

The globe P is attached by sliding the crown K up the burner-tube, passing the neck of the globe over each horn of the tripod D in succession, and then lowering the crown K until its lip encircles the neck concentrically and holds the globe securely. In action, the fresh air, warmed by contact with the globe, enters at the ducts O (which are opposite to each other), passes up the interior of the cap N, and surrounds the air inlet concentrically—thus isolating the air inlet from the burnt gas, which can only pass through the ducts L, which do not communicate in any way with the fresh air ducts.

Discharging and Charging Gas-Retorts.

GUEST, A. A., and GIBBONS, W. P., of Lower Gornal.

No. 4879 ; Feb. 27, 1911.

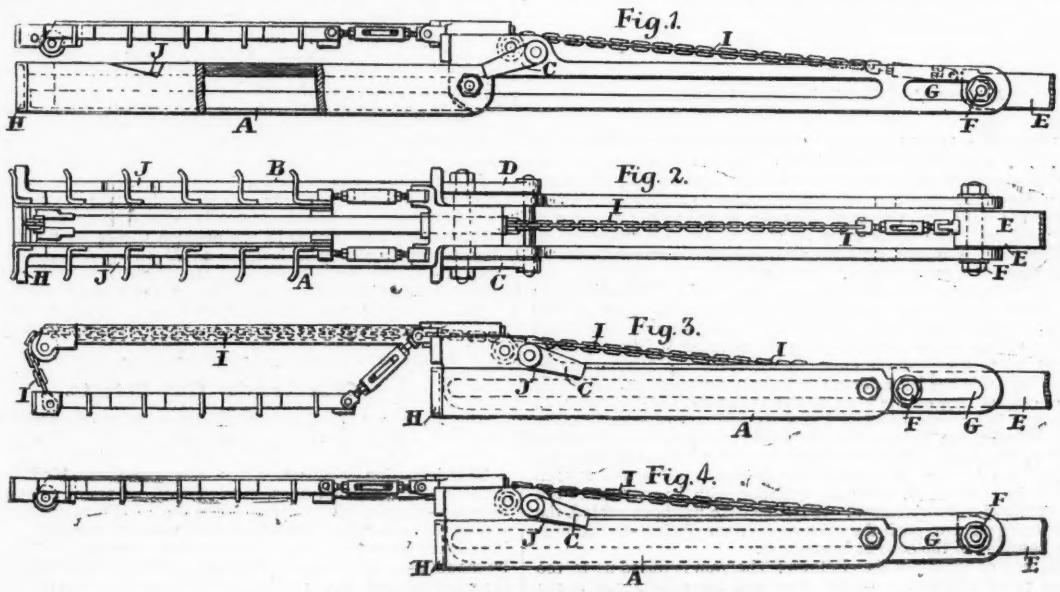
This invention has reference to machines for discharging coke from one end of a double-ended horizontal retort and for the charging in of the coal at the other end of the retort. It is a modification of patent No. 30,131 of 1909.

An arrangement was there described of one or more drag bars adapted to be moved forward in a charging trough along the bottom of the retort so as to carry the charge forward with the charging trough ; the bars being furnished with mechanism adapted to lift them up out of the charge in the retort and return out of the retort over the top of the charge. The sides of the charging trough which were pushed forward into the retort with the drag bars occupy a certain amount of space in the retort, which is filled up by the setting of the charge in the retort as the side bars of the charging trough are withdrawn. But it is evident that if the drag bars could be arranged to operate without a charging trough passing into the retort, the charge of coal fed into the retort could be considerably increased ; and this is effected by the invention, which also comprises means whereby the construction and operation of the charging machine are simplified.

Fig. 1 is a side elevation of the discharging and charging charger—the parts of the charger being shown in the position they occupy when the charger is returning from discharging the coke from the retort. Fig. 2 is a plan of fig. 1. Fig. 3 is a side elevation of the charger shown in fig. 1, but showing the position of the parts during the time the drag bars are lowered and are delivering coal into the retort. Fig. 4 shows the position its parts occupy when the charger has been withdrawn from the retort after discharging the coke, and the carriage has been pushed forward to allow of the drag bars being lowered to receive the charge of coal—this also being the position of the parts of the charger after the drag bars have been raised through the coal to the top of the retort and the charger is being withdrawn out of the latter.

The discharging charger is carried by a traveller arranged outside the retort and furnished with mechanism for pushing the charger into the retort and for withdrawing it, and also for raising and lowering the charger to suit the heights of the various retorts in the beds and for moving the charger along to the various beds of retorts. As in other like apparatus, the traveller which carries the discharging charger supports an open topped trough (of slightly less cross sectional area than the retort) outside the retort, and operated by mechanism carried by the traveller so as to be moved from one retort to another and to fit against the retort mouthpiece about level with the bottom of it, and along which the charger works when moving into or out of the retort.

The apparatus acts as follows: Assuming that the discharging charger carried by the traveller has just finished charging a retort with coal, and is out of the retort, the parts would be in the position shown in fig. 4 ; and in order to discharge coke from another retort, the parts must first be brought to the position shown in figs. 1 and 2. To effect the change of position it is necessary to move the bars A, B (fig. 4) to the left, or conversely to move the other parts to the right ; and therefore the pawls C D are turned over to allow this to be done. When the bars have been moved, the pawls engage as shown in figs. 1 and 2. Upon the push bar E being moved to the left by the mechanism of the traveller, the pin F slides until it contacts the left end of



Guest and Gibbons' Retort Discharger and Charger.

the slot G, whereupon the thrust is transmitted to the push-plate. In this manner the discharger and the carriage are now pushed forward into and through the retort; the push-plate H coming into contact with the coke and discharging it from the retort. As will be observed, the chain I slackens at the beginning of this discharging movement; but the drag bars do not interfere with the coke because they simply rest upon the top of the side bars A B.

To withdraw the apparatus from the retort, the push bar E is moved to the right, with the result that the pin F slides in the slot G, and thus tightens the chain whereby the drag bars are lifted off the side bars before the actual return movement of the remainder of the apparatus takes place. The discharging operations being now finished by the return movement, the apparatus is adapted for charging the retort with coal by first turning over the pawls C D from the position shown in fig. 1 to that shown in fig. 3. The side bars are now pushed from the position they have in fig. 1 to that they have in fig. 3, and are there retained by the pawls which engage with the notches J. The push bar now moves to the left until the pin F is at the left-hand end of the slot; the chain being thereby slackened and the drag bars lowered to the position shown by fig. 3. In this position the drag bars are on the bottom of the trough, out of the retort.

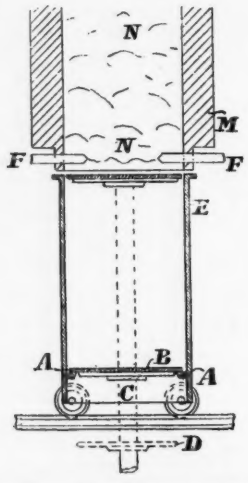
The trough is now filled with coal from a shoot; the drag bars serving to hold the coal together. A forward movement of the charger, which is now in the position shown by fig. 3, is made right to the other end of the retort, so as to deposit therein this one section of the charge. The charger is next drawn back; and the first movement of the push bar to effect this draws the cross pin F to the right-hand end of the slot G and raises the drag bars up clear of the charge into the position shown by fig. 4. They thus pass out in their highest position over the top of the coal right into the trough at the outside of the retort; and then on the push bar—moving another forward stroke. The first effect is to lower the drag bars again into the position shown by fig. 3 and into the bottom of the trough, which is again filled with the coal carried into the retort by the drag bars, on the next forward movement of the machine and up to the end of the section of the charge which was last deposited. Then the charger is again withdrawn and the operation repeated until the whole of the charge has been delivered into the retort.

Discharging Coke-Ovens or Retorts and Cooling the Coke.

ARMSTRONG, J., of Victoria Street, S.W.

No. 4427; Feb. 22, 1911.

This invention is "for the purpose of making coke from coal, of better quality, better colour, and with less breeze from breakage."



Armstrong's Coke Discharger and Quencher.

The illustration is said to show "a simple vertical coke-oven or retort . . . showing the method of discharging and cooling the coke." N represents the chamber containing the coke, and M are the outside walls of the chamber. F are forks that go through the lower portion of the walls, and penetrate the coke so as to fix it at any convenient position. The forks may be worked by any "convenient mechanism." C is a ram working vertically inside the cylinder E, which latter can be moved on rails on wheels.

When the oven or retort full of coke is ready to be drawn, the forks F are pushed into the coke, so that it is firmly secured. The cylinder is then run immediately under the retort, and the ram is then raised from the position of D, and, ascending the cylinder, it lifts the loose bottom B up to the position immediately under the bottom of the retort. When this has been done, the forks are withdrawn. The full charge of coke is now on the head of the ram, which is lowered to B. But before it is lowered quite so far, if the column of coke is taller than the cylinder, the forks are again applied, both to arrest the coke descending, and to cut it off at this point. The ram then descends further, till the bottom B rests on the ledges A. The ram is then lowered to the position D, when the cylinder, with its contents of hot coke, is removed to be quenched. After the coke has been cooled, the ram is again applied to push the coke out of the cylinder—thus obviating any handling of the coke or breaking it.

The method of operation is as follows: The ram is raised up to the door, and (after the weight of the door and the coke above it are carried by the ram) the forks withdrawn; and the ram is then lowered and the forks applied when required to cut off the coke; and the cylinder is removed with the hot coke for quenching.

Regulating the Lighting and Extinguishing of Gas-Lamps.

KENT-JOHNSON, A. G., of Balham, S.W.

No. 7677; March 28, 1911.

This apparatus for automatically lighting and extinguishing gas-lamps is operated by increasing the pressure of the gas in the mains.

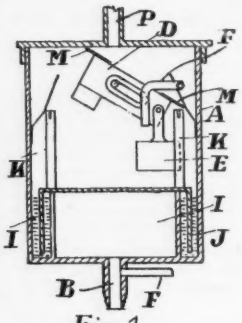


Fig. 1.

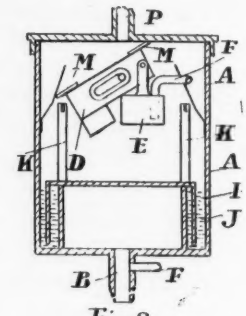


Fig. 2.

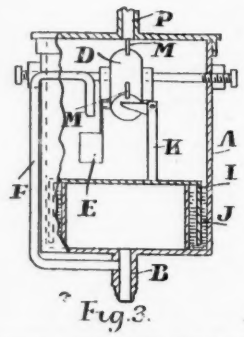


Fig. 3.

Kent-Johnson's Lamp Lighter and Extinguisher.

Fig. 1 is a vertical section of the apparatus, showing the position of the mercury trough when the lamps are lighted. Fig. 2 shows the mercury trough when they are extinguished. Fig. 3 is a vertical section at right angles to figs. 1 and 2.

Inside the vessel A is a tube D, to one end of which is pivoted a trough E, containing mercury, into which dips, when the trough is in the position shown by fig. 2, a pipe F, the lower end of which is inserted in the nozzle B. The tube D (supported on two horizontal pins which engage with slots on opposite sides of the tube) contains mercury; and when the lamp to which the apparatus is attached is to be lighted or extinguished, the tube is canted over into the positions shown by figs. 1 and 2 respectively, by means of a bell I, which moves in the trough J at the bottom of the vessel. To the top of the bell I are secured two standards K, to each of which is pivoted a detent, which is free to move upwards but is prevented from moving downwards below the horizontal.

When the apparatus is fitted to the lamps, the bell I rests on the top of the trough J; and the tube D is in the position shown by fig. 2. So long as the pressure of gas in the mains is normal, the lamps are extinguished. But when the pressure is raised above the normal the bell I rises, and the detent, which is pivoted to the standard K on the left of fig 2, engages with the wire M on the lower end of the tube D; the upward movement of the bell brings the tube D horizontal; and the displacement of the centre of gravity caused by the horizontal movement of the tube and the movement of the mercury in the tube causes the latter to fall over into the position shown by fig. 1. The mouth of the pipe F being now unsealed by the downward movement of the trough E, the gas passes from the nozzle B, through the pipe F, into the vessel A, and thence, through the outlet P, to the burner.

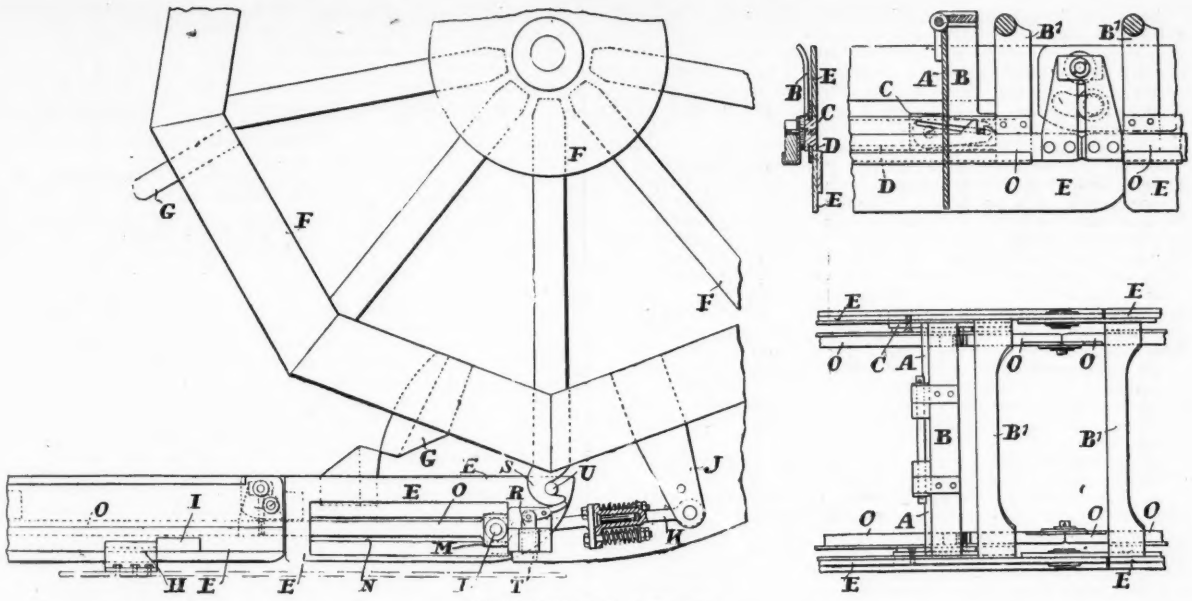
When the pressure in the mains is reduced to the normal, the bell I falls, leaving the tube D in the position shown by fig. 1, and when the pressure in the mains is again raised above the normal the bell I again rises, and the detent on the standard K, to the right of fig. 1, comes in contact with the wire M at the lower end of the tube D, and raises it until the tube falls over into the position shown by fig. 2—raising the mercury trough E and sealing the mouth of the pipe F.

Chargers for Gas-Retorts.

ALDRIDGE, J. G. W., of Victoria Street, Westminster.

No. 7547; March 25, 1911.

This invention relates to chain chargers of the kind described in patents Nos. 10,480 of 1902, 5375 of 1906, 27,117 of 1906, and 26,056 of 1908—"to provide means whereby the density of the charge can if desired be increased, thereby enabling a greater quantity of coal to be introduced into the retort at each charging operation." This is attained by mounting one or more of the push-plates to slide longitudinally in the chain so that they can be pushed forwards independently of the



Aldridge's Gas-Retort Charger.

chain towards the end of the charging stroke and thus compress the charge.

A side elevation of a portion of the rear end of the chain and polygonal actuating drum is given; also a side elevation and plan of a portion of the chain provided with a series of independently movable push-plates.

The push-plates A are pivotally suspended from independent arched stays or saddle bars B (in addition to fixed stays B^1) not fixed to the chain but carried upon slippers C, which move horizontally in slots D in the side plates E of the chain, so that all the intermediate push-plates are free to move forwards or backwards in the line of the chain to the extent of the slots—the front push-plate being fixed.

The chain wheel or drum F is provided with driving arms G, adapted to engage blocks on the side plates E for driving the charger into the retort; the inward stroke of the charger being arrested by fixed stop-blocks H in the path of projections I on the side plates E of the chain. In the position illustrated, the charger has reached the end of its inward stroke; and the sliding push-plates are about to be actuated to further compress the charge. In this position a bolt R, previously held raised by the draw-hook S of the chain wheel acting on a lever, is allowed to fall into a slot T in a fixed part through the draw-hook leaving the chain—thus locking the chain against backward movement until released.

The mechanism for actuating the sliding push-plates comprises arms J on the wheel or drum F joined by a connecting-rod K to a cross head L, which connects the rearmost side plates of the chain and is fitted with sliding blocks M arranged to slide in slots N in the rear-side plates. The connecting-rod is preferably formed in two parts, one arranged to slide in the other, and provided with flanges through which bolts are passed carrying springs, which normally hold the flanges together, but are adapted to be compressed and prevent damage to the parts through sudden application of power on the return stroke.

Attached to the sliding cross-head L are two jointed side rods O, mounted to slide along the inner faces of the side plates, and having butt-joints, the pivots of which are coincident with the pivots of the chain plates in the retracted position of the side rods, so as to allow of their being coiled on the chain wheel or drum with the chain.

The slippers carrying the push-plates are mounted to slide in the chain plates, and each is provided with a pivoted link or arm carrying at its free end a pin projecting through an inclined slot in a plate fixed to the side plate of the charger and adapted to be engaged by projections on the upper edge of the side rods. The forward projections are high, and the rear ones lower.

The inclination of the slots is such that, by riding up them, the pins are raised above the level of the rear projections, but not above the level of the forward projections. Thus as the side rods move forwards, the slippers and the push-plates are left behind. The inclined slots are so arranged that the forward push-plate is left behind first, the second one next, and so on; and the distance that each is moved forward is such that the intervals between the push-plates are equal both before and after the movement. Thus the sections of coal are compressed to the same extent.

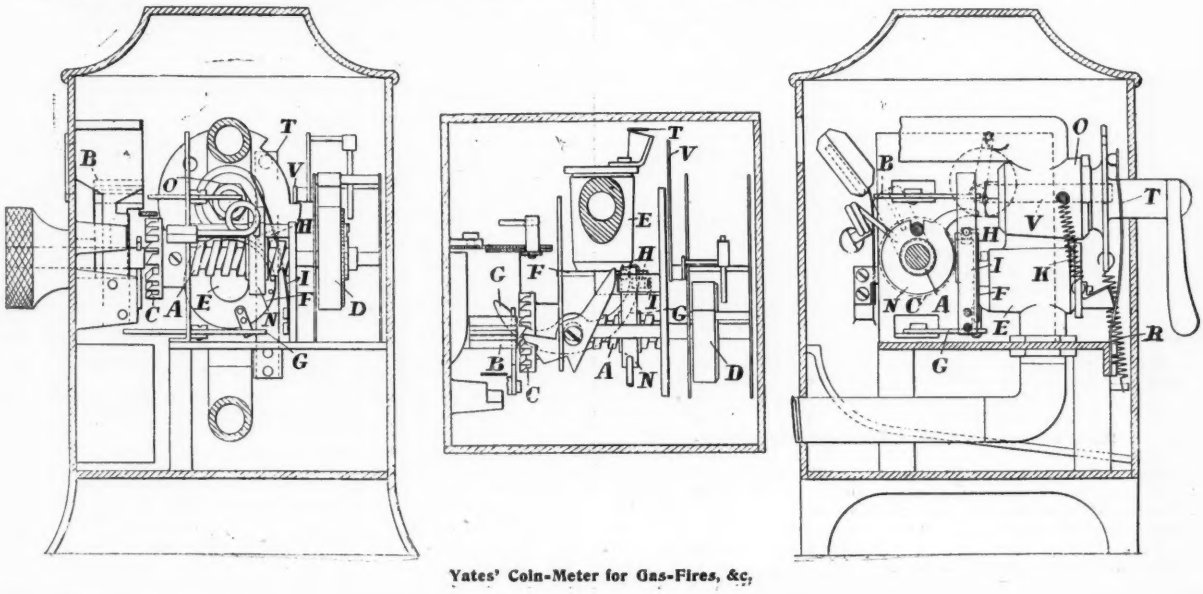
In operation, the driving drum or chain wheel forces the chain into the retort until it reaches the position first shown. At this point the chain is stopped by the blocks H. The chain wheel continues to revolve until the last driving arm G passes clear of the radial driving block on the chain, and the drawing-hook S leaves its pin U, allowing the bolt R to fall into the slot T to lock the charger. At the same time the connecting-rod K moves the side bars O, through the cross-head L, the length of the slots in the side plates E. The side bars carry with them the saddle bars B, and the push-plates suspended thereon. On the return stroke, the chain is held in position until the cross-head L has returned, bringing with it the side bars and push-plates to their starting positions; then the draw-hook S releases the locking bolt R, and also engages with its pin U to withdraw the charger from the retort—the whole being then wound round the wheel in the usual way.

Coin-Freed Meters for Gas-Fires, &c.

YATES, H. J., of Birmingham.

No. 13,501; June 6, 1911.

This invention relates to coin-freed meters for gas-fires and other heating appliances as described in patent No. 3377 of 1910—"whereby greater simplification and more advantageous construction and arrangement of the mechanism are obtained."



Yates' Coin-Meter for Gas-Fires, &c.

As shown, there is a coarse-pitched screw A between a clock and a two-part coin-carrier; and by means of a coin, the parts B and C of the coin-carrier are connected so that motion can be transmitted from the external handle through the screw to the clock D for winding up the spring. The primary gas-valve E is preferably of the tapered-plug type, and carries on one end a plate F adapted to be engaged both by a coin-actuated lever G and a spring-controlled pawl H, preferably secured to a spring blade I, fixed at one end and free at the other. The pawl engages one end or edge of a peripheral projection on the plate F when the valve is open, but rests on, or is held away from, the projection when the valve is closed (as shown). The plate F may be connected to a spring K, or may be attached to a plate or lever on the other end of the plug (as shown). The lever G is shaped at one end to lie across the path of the coin inserted in the coin-carrier. When the coin approaches the end of its movement, it imparts sufficient motion to the lever G to open the primary gas-valve, by pressing against a projection on the plate F; and the valve is then held open against the action of the spring K. Release of the valve, after the predetermined quantity of gas has been delivered, is effected by a nut N, which slides upon the screw A, and is adapted, by means of an extension, to press aside the spring blade I, and so lift the pawl H out of engagement with the projection on the valve when it reaches a certain position. When thus liberated, the valve is instantly closed by its spring K.

Adjacent to the primary gas-valve E is a secondary gas-valve O, provided with an external handle to permit of its manipulation by the user. This valve is also provided at one end with a plate or lever, to which a spring R is attached. For securing the tap in the open position against the action of the spring, a pawl, mounted upon a spring blade T and adapted to engage an aperture in the plate or lever, is employed. The pawl is rounded at its end (or the edge of the aperture with which it engages is rounded), so that when a closing movement is imparted to the tap by the external knob or handle the pawl is automatically pressed aside out of engagement. On the same plate or lever a slot or projection is provided, whereby the plate can operate a lever V arranged in conjunction with the clock stopping and starting mechanism. The latter consists simply of a plain lever having a spring blade secured to it and adapted to bear upon the rim of the balance-wheel of the clock. The disposition of the blade is such that, when it is lifted out of abutment with the wheel, it imparts to the latter a sufficient tangential effort to ensure the starting of the clock. When the primary gas-valve is closed by the nut on the screw above referred to, a projection from one end of the valve strikes the blade T, carrying the retaining pawl of the secondary tap, and, by disengaging the pawl from the tap, permits the latter to be closed under the action of its spring, and at the same time causes the clock to be stopped.

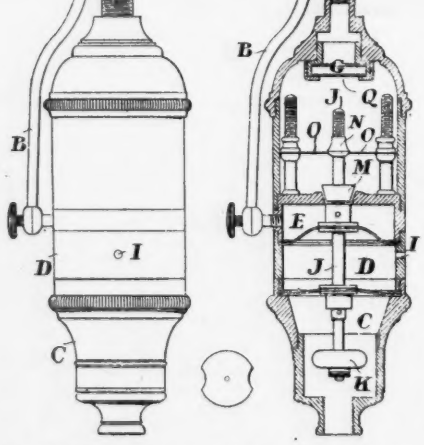
For closing both the primary and secondary valves prior to each operation of the primary valve by the inserted coin, a bell-crank lever is arranged with one end in the path of the moving coin and the other end in co-operation with the blade I carrying the pawl H by which the primary valve is held open. During the initial part of its movement, the coin presses against the lever and causes it to withdraw the pawl out of engagement with the valve, and thereby permits the latter to be closed. Simultaneously with the closing of the primary valve, the secondary valve is closed automatically in the manner described.

Automatic Gas Lighter and Extinguisher.

HARDY, J. T., of Sheffield.

No. 17,454; Aug. 1, 1911.

This is an "improved construction" of apparatus described in patent No. 9390 of 1899, in which a flexible diaphragm is used to actuate the valve, and by means of which large numbers of street lamps may be lighted, and also extinguished, at the required time, automatically and simultaneously, and also by which the pressure of the gas passing to the burner will be regulated.



Hardy's Automatic Lamp Lighter and Extinguisher.

The action of the apparatus is due to the variation in the pressure of the gas acting upon flexible diaphragms and valves in conjunction with a lighted bye-pass or pilot light. It consists of a tubular casing, the interior of which is divided into a number of chambers, the lowest first receiving gas. This chamber, C, is separated from the one above it, D, by a diaphragm of very flexible material, and D is also separated from E by a similar diaphragm, the intervening space being provided with one or more inlets I, open to the atmosphere so as to admit air to the interior. Both diaphragms are secured at their circumferential edge to the casing and to a central valve-stem J, upon the lower end of which are placed counterbalance weights K. The central portion of the valve stem is tubular, having an inlet in the gas-chamber C, and an outlet in the chamber E, through which gas can pass from the lower to the upper chamber above the diaphragm. The chamber E provides a constant supply of gas to the bye-pass tube B.

In the centre of the roof of the chamber E is an opening, which forms the seating for a valve M, carried upon the valve-stem and having means for its adjustment upon the stem relatively to the seating. The valve is raised from its seat by the pressure of gas acting upon the under side of the lower diaphragm, and thus gas passes from the chamber C, through the tubular portion of the stem, into the chamber E.

The valve-stem extends above the valve M, in order to carry an adjustable retaining device N—preferably a cone screwed upon the valve-stem; and when the valve is closed, the position of the retainer is underneath two very flexible catch plates O, carried horizontally upon two small pillars rising from the face of the valve floor. These catch plates are adapted to allow the retainer to pass between them when raised by the pressure of gas, but to prevent it, and with it the valve M, from descending until overcome by the weights K.

The object of the retaining device is that, if the night pressure of the gas in the mains is lowered to any point slightly above the arranged day pressure, the catch plates will support the retainer N, and hold the valve sufficiently open to give the full supply of gas to the burner until, on a further lowering to day pressure, the weights K overcome the sustaining power of the catch plates and close the valve.

Before reaching the burner, the gas passes through a controlling chamber G, provided with a thin plate valve Q, consisting of a disc with a small centre hole (see detail) and with preferably larger gas-passages cut out of its periphery. Under ordinary pressure the disc rests at the bottom of the chamber, and gas is capable of passing through all the openings; but if the pressure is above the normal, the disc is carried up by the gas and held against the flexible seating, so as to close the larger openings and only leave the small centre opening for gas to pass to the burner.

APPLICATIONS FOR LETTERS PATENT.

6004.—RICHARDSON, W., "Compressors or pumps." March 11.
6007.—HARRIS, J. P., "Gas-cooking ovens." March 11.
6009.—HANKS, F. T., and ROUTLEDGE, W., "Slot-meters." March 11.
6026.—MARTON, G., "Valve for gas-mains." March 11.
6073.—NEW INVERTED INCANDESCENT GAS-LAMP COMPANY, LIMITED, "Inverted lamps." A communication from Carl Reiss. March 11.
6091.—HUSBANDS, J. A., "Gas-lighters." March 11.
6135.—HESKETT, T. J., "Gas-producers." March 12.
6165.—ALEXANDER, G. H., and ROBINSON, W. G., "Meters." March 12.
6190.—METROPOLITAN GAS-METERS, LIMITED, and FORSTER, J. D., "Money-boxes for prepayment apparatus." March 12.
6213-4.—SHEPHARD, J. W., and JONES, F. A., "Taps or cocks." March 12.
6217.—GARRATT, H. W., "Burner." March 12.
6219.—EPSTEIN, G. J., "Utilization of combustion." March 13.
6220.—WARDLE, E., and HAMBLETON, F., "Manufacture of combustible gas." March 13.
6236.—DRUMMOND, J. & A. Y., "Gas-fires." March 13.
6279.—LINES, A. A., and HASSALL, W., "Mantles." March 13.
6364.—ROGERS, F., "Pyrometers." March 14.
6412.—COX, H., "Gas-cooker base." March 15.
6454.—HOWES, J. T., "Meter diaphragms." March 15.
6463-4.—HIBBERD, C. E., and GOAD, F. L., "Gas-meters." March 15.
6465.—SMITH, H. C., "Flexible tubing couplings." March 15.
6467.—OLESEN, M. A., "Gas-generators." March 15.
6471.—BURKHEISER, K., "Production of sulphite and sulphate of ammonia in the manufacture of gas." March 15.
6517.—KEITH, J. & G., "Electrically-operated valve-controlling devices." March 16.
6553.—LIEBLICH, E., "Compressing air or gas." March 16.
6572.—WATERHOUSE, L., and BOOTH, J. B. S., "Carburation of air." March 16.
6590.—WEST, W., "Valves." March 16.

Lighting of Smithfield Market.—Under an agreement just sealed between the City Corporation and an electric supply Company, the latter are given a monopoly for the lighting of Smithfield Market until 1972; but a clause regulating the price chargeable for current to a maximum of 4½d. per unit inclusive, is inserted. The rent payable is to be a percentage of the gross receipts of the Company.

Whitby Gas Company.—At the recent annual meeting of this Company, the Chairman (Mr. F. Richardson) said that the past year was an excellent one in all departments. The receipts showed a considerable increase over the previous year; those for gas supplied to the ordinary consumers and for public lighting amounting to £7068, against £6842 in 1910—a rise of £226. The rental of meters and stoves was £25 better. The principal increase, however, was in residual products—sale of coke £969, against £931, an increase of £38; tar £313, against £259, an increase of £54; ammoniacal liquor £302, against £234, an increase of £68. Coals cost slightly more, owing to the extra output of gas, amounting to about 2 million cubic feet. The balance on profit and loss account, after payment of interest on the debenture stock, &c., was £1359; and, after payment of the half-year's dividends to the 31st of December, there would be a balance of £441 to carry forward. The report and accounts were adopted; and dividends at the rate of 6 and 4½ per cent. per annum were declared. The Secretary and Manager (Mr. W. M. Galleway) and the staff were thanked for their services.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Horizontal Retorts.

SIR,—The claims of various vertical retort systems are so frequently being urged by means of comparative statements of high yields of gas per ton and low fuel consumption realized on isolated plants in contrast with the average returns from plants of various types (more or less antiquated) of horizontal retorts, that it is interesting to note the independent analytical observations of Dr. Davidson, who appears (like myself) to be not yet convinced on these points.

No comparison is effective wherein the results from existing works employing the older system have only the sections which have been recently renewed actually brought up to date, as, of course, the older sections for the present remain of obsolete and inferior types.

In this connection I would ask for the careful consideration of your readers to the table of results accomplished by the Metropolitan and Suburban Gas Companies in the past six months prepared by Mr. Bradfield and published in your issue of the 5th inst. From this it will appear that in two cases makes of over 12,750 cubic feet of gas per ton were obtained; in one, 12,392 cubic feet; and in three cases, over 12,000 cubic feet. It must also be noted that the illuminating power is nowhere so rigorously tested as in and about the Metropolis; so that no sacrifice of quality could have been made. In fuel percentage, again, such results as 13·45, 14·21, 16·35, and 19·5 per cent. were attained.

It is within my knowledge that in most of these cases the results are much reduced by the large proportion of less efficient plant necessarily employed, but which will in time be all brought up to the newest types of horizontal retort work.

I possess figures from other works of importance, corroborating those tabulated; and the whole tends to confirm an impression I have urged, that the last has not by any means been heard by gas people of the horizontal retort.

I find I have yet to speak of the wages cost—in two cases below 1¼d., in two below 1⅜d., and in three cases (practically) 2d. Outside cases give me well below 1½d.

As the whole *corpus* of plant is renewed, these figures again must improve. What can be urged on the other side?

H. E. JONES.

Palace Chambers, Westminster, March 16, 1912.

Coal Strike—Rates and Taxes—Assessments.

SIR,—Our attention has been called to the letter, signed "Secretary," in your issue of this date, upon which we have to make the following remarks.

(1) The first question put is as to whether an ordinary company, without any Provisional Order or Act of Parliament, is obliged to supply its consumers with gas during the present crisis; and if so, whether such a company can charge a higher price. This is not a question which we should have set ourselves to answer, if it were not for those which follow. In our opinion, there is no obligation whatever, in the absence of a Provisional Order or Act of Parliament, or some private agreement.

(2) Land-tax is chargeable on "all messuages, lands, and tenements," &c., &c., and "all hereditaments of every kind situate within the parish." This might be considered to include gas-mains, were it not for the case of "Chelsea Water-Works Company *v.* Bowley" [1851, 17 Q.B. 358]. In this case it was decided that the company was not liable to be assessed to the land-tax for the land occupied by its pipes. No doubt, the reason was that land-tax is not chargeable upon a person who has a mere easement. In this respect the land-tax differs from the poor rate. In our opinion, the decision governs gas-mains as well as water-mains.

(3) In our opinion, there is no law entitling gas-mains to be charged upon one-fourth of their value, as is the case with railways, &c., for general district or special rate purposes. The Public Health Act, 1875 [38 and 39 Vic., c. 55] is the Act giving this exemption. Section 211, sub-section 1 (*b*) deals with the general district rate, and section 230 with special expenses rates. It is, however, possible that there may be some rate established under a Local Act, conferring the exemption in question, or else defining it. See the case of "*Rex v. Shrewsbury (Trustees)*" [3 B. and Ad. 216].

RYDE AND SONS.

49 *and* 50, *Parliament Street, S.W., March* 19, 1912.

A Calorific Power Standard for Gas.

SIR,—I have read with much satisfaction the paragraph in last Tuesday's "JOURNAL" regarding the views expressed by Mr. Herring as to the desirability of making a start towards the adoption of a calorific power standard for gas; and your remark that his suggestion is one deserving consideration.

The necessity for this reform, which had already been discussed from time to time in another connection, has impressed itself strongly upon me as a maker of gas apparatus for heating; and in papers which have appeared in your columns on more than one occasion, I have pleaded for three things, of which my experience in that direction had shown me the need—viz., higher pressure, constant pressure, and constant calorific value. It is encouraging to see that the standardization of calorific power has an advocate in so authoritative an exponent of the gas-making point of view as Mr. Herring. I hope that he will continue to press his views on this matter; and I confidently trust that ere long the other two suggestions I have named will find equally powerful support among the gas profession.

New conditions have arisen, and are rapidly growing more general; and new conditions ever call for corresponding adaptation of methods. It is always desirable that the call for such modifications of method should come from, or be supported by, those who are so placed that they are the first to become aware of the need. The makers of gas-consuming apparatus are apt to be the first to find themselves "up against" the new conditions. From their ranks, therefore, it is but natural that the question should be pressed. The gas profession have always been ready to meet the needs of the time; and I have no fear but that they will do so in this case, once the nature and clamancy of the need have been sufficiently shown. Nor will any fair-minded man dream that to voice a new need is to imply censure or complaint.

The general use of incandescent lighting with its bunsen burner, calling for calorific rather than direct illuminating power, has been followed by a wide movement for the use of gas for heating. The great new demand for gas arising from the vogue of the gas-heated radiator has been reinforced by that of the modern gas-fire, and the modern types of gas-heated water apparatus—all of them consuming gas for purposes other than lighting to a degree immeasurably beyond the demand of a few years ago. And, once again, it is for calorific power that they call. It is to meet this new state of things that I have formerly urged, and once more urge, the necessity for the new arrangements I have indicated. Modern apparatus of the classes I have named, in order to continuously maintain those excellent results that have made their use so general, naturally require more or less uniform conditions of gas supply, in respect both of pressure and calorific power, and hence the urgent need that their progress in public favour shall be fostered by the establishment of such conditions rather than hindered by their absence. An object so manifestly in the interest of all branches of the gas industry was bound to find favour among the profession; and I hail Mr. Herring's suggestion as the harbinger of a general movement in this direction.

I should like to close with just a word on a kindred subject. In the frequent discussions of recent years regarding the effect of the combustion of gas on the atmosphere of apartments, the fight has hitherto raged chiefly round the CO_2. Of late, however, there has been a very general diffusion of the knowledge that the CO_2 is in itself innocuous. But while there is thus good hope that the bogey of CO_2 may soon be completely done with, behind it comes the question of SO_2, which I have reason to know is certain before long to come prominently to the front. This is a matter which, I think it will be agreed, merits most serious consideration on the part of all the interests involved.

H. JAMES YATES.

Aston, Birmingham, March 23, 1912.

The Heating Efficiency of Gas-Circulators.

SIR,—There has recently come to our hands a list of gas-heated circulators of well-known make; and we notice with surprise that a claim to 97½ per cent. efficiency is made.

To claim this very high efficiency from a circulator, which when installed in the average house cannot give more than from 60 to 70 per cent. working efficiency—which after all is the real efficiency—seems to us very misleading, not only to gas engineers but also to the general public.

Is it not time that manufacturers claiming such high efficiencies as these should also give the methods whereby the tests have been made, and so enable prospective buyers to judge somewhat for themselves as to the efficiencies they are likely to obtain?

EXPERIMETERS.

March 18, 1912.

Gas for Bailiffe Bridge.

A Local Government Board inquiry was held recently, by Mr. H. S. Bidwell, regarding an application by the Hipperholme Urban District Council for a Provisional Order authorizing them to supply gas in the Bailiffe Bridge portion of the district. It was explained by the Clerk (Mr. G. W. Thompson) that for many years Bailiffe Bridge had been supplied with gas by a private Company, who approached the Council with a view to the latter taking over the undertaking; and the inhabitants of the district had urged the Council to do something for them, the charge for gas being comparatively high. The Council being sensible of their obligation to the ratepayers, an arrangement was come to, with the result that the Order was applied for. A portion of the proposed area of supply was within the Halifax Corporation scheduled gas area; and another part was believed to be within the limits of the Bradford gas area. In respect to the portion within the Halifax gas limits, he was able to say that the willingness of the Halifax Corporation reasonably to discuss the boundary of the proposed area so far as they were concerned had resulted in a limit being agreed upon. As to the portion of the Bradford gas area, it appeared that no rights of gas supply by any statutory authority had ever been exercised there. Further, the Bradford Corporation had not lodged any objection to the Order. The Town Clerk of Brighouse (Mr. J. H. Rothwell) said Brighouse objected to the proposal, as the Corporation had an agreement with the Company referred to, and had manufactured gas for the area for over thirty years—having incurred capital expenditure to do so. Mr. Saunders suggested that Brighouse had exceeded its legal powers. Mr. Priestley said he understood that Halifax had already scheduled the district, and were ready to supply gas. The Inspector, however, pointed out that the whole of the area was not within the Halifax limits, and that they had waived their right over the part that was in their area. Mr. Priestley replied that he wished to protest against Halifax not exercising their right. Mr. Shaw objected to the scheme on the ground that a supply of gas could more advantageously be secured from Halifax and Bradford. Referring to the financial aspect of the transaction, the Clerk said the Council applied for sanction to borrow £750. The undertaking was to be purchased for £241 10s.; sundry renewals of existing mains would cost £100; and then there were proposed extensions, amounting to £158 10s.; and meters, £202. The Company threatened to close-down and throw the place in darkness, and the Council felt impelled to take over the business, and instal machinery. About £200 had been expended up to date.

As gas-motor manufacturers, the firm of A. G. Sutherland, Limited, was registered on the 14th inst., with a capital of £10,000 in £1 shares. The offices are at No. 59, Pritchett Street, Birmingham.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read a second time and committed: Christchurch Gas Bill, Herne Bay Gas Bill.

Bills reported: Bawtry and Tickhill Gas and Water Bill [preamble not proved], Leatherhead Gas Bill, Sidmouth Urban District Council Bill, Tendring Hundred Water and Gas Bill.

Bill read the third time and passed: Belfast Corporation Bill.

On the motion of the Chairman of Committees, the Gas Companies (Benefit Funds) Bill has been divided into five Bills—viz., Brighton and Hove General Gas Company Bill, Lea Bridge District Gas Company Bill, Maidenhead Gas Company Bill, North Middlesex Gas Company Bill, and Southgate and District Gas Company Bill; and they have been read a second time and committed.

The South Metropolitan Gas Company petitioned against alteration in the South Suburban Gas Bill.

The opposition to the Bawtry and District Gas Bill has been withdrawn.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bill read the first time and referred to the Examiners: Belfast Corporation Bill.

Bills reported: Bedwellty Urban District Council Bill, Church Stretton Urban District Water Bill.

The Glasgow Boundaries Bill, the Glasgow Corporation (Water) Bill, and the Glasgow Water (Charges) Bill—originally Provisional Orders applied for to the Secretary for Scotland, under the Private Legislation Procedure (Scotland) Act, 1899—were on Monday last week presented and read the first time.

The South Metropolitan Gas Company petitioned against alterations in the Annfield Plain and District Gas Bill and the Fleetwood Gas Bill.

The petitions presented by the Ashborne and District Gas Company against the Ashborne Urban District Council (Gas) Bill, by the Luton Rural District Council against the Dunstaple Gas and Water Bill, and by the Commissioners of the Kendal Reservoirs and owners, &c., of mills against the Windermere District Gas and Water Bill, and by the Plympton St. Mary Rural District Council against the Ivybridge Urban District Water Bill, have been withdrawn.

CHEMICAL MANUFACTURERS & GAS-RESIDUALS POWERS

DECISIONS OF THE COMMITTEES.

Tuesday, March 19.

SOUTH SUBURBAN GAS BILL.

After hearing Counsel on the South Suburban Gas Company's Bill on Friday, March 15, the House of Lords Committee, it will be remembered (*ante*, pp. 815-818), reserved their decision until the following Tuesday morning. When the Committee met on that day,

The CHAIRMAN (Lord Ritchie) announced that the Committee had decided that the Bill might proceed, subject to the amendment regarding the price of gas in the Bromley district, and subject also to the following reservation. The Committee were of opinion that the Company should not be allowed to purchase materials other than those required for the manufacture and supply of gas, for any purpose except that of working-up their own residual products. The Committee were not prepared to accept the amendment which was suggested by Counsel for the United Alkali Manufacturers' Association; and they left it to Counsel on both sides to draw up some proviso which would give effect to the decision he had announced.

Mr. J. D. FITZGERALD, K.C. (for the Alkali Manufacturers' Association), said that if the promoters would draw up a proviso and submit it to him, they would probably be able to agree on some form of words to carry out the Committee's decision.

Mr. BALFOUR BROWNE, K.C., said he appeared for the South Metropolitan Gas Company on a petition which they had presented against alterations in the Bill.

The CHAIRMAN remarked that he was much too late to be heard now.

Mr. BALFOUR BROWNE replied that the clause was only put before the Committee on Friday, and until then he was not able to present a petition. As soon as he saw the clause, however, he presented his petition against alterations. There was a case in which a petition against alterations was heard after the Bill had been in progress for eight days. He could not be heard until alterations had been made; and he asked the Committee to hear him on the point.

The CHAIRMAN said that, as the Bill was closed on Friday, the Committee would not re-open it on such a point as this at so late a period.

It was decided to discuss the new clause on Thursday morning.

Thursday, March 21.

When the Committee met again this morning to consider the clause outlined in the Chairman's decision on Tuesday,

Mr. HONORATUS LLOYD, K.C., for the South Suburban Gas Company, said that the promoters had drafted a clause with a view to carrying out the Committee's decision. It was as follows:

> The South Suburban Company shall not purchase residual products arising from the manufacture of gas other than those required for the manufacture or supply of gas by the South Suburban Company, or the conversion or working-up of residual products arising therefrom.

This followed closely the exact wording used by the Chairman in giving the Committee's decision; but it did not introduce the word "materials." The decision was that the Company should not purchase "materials." This was important; for the reason that, if the word "materials" was put into the clause, the Company would be limited in a way other than suggested by the Committee, because it would exclude the Company from purchasing materials save the materials for the particular purpose referred to in the clause. There were, however, certain other things which the Companies were authorized to do. For instance, they could deal in fittings; and for this purpose it was necessary to buy materials. If, therefore, the word "materials" was inserted in the present clause, it would limit the Company's right to deal in materials for carrying on the sale of fittings. Again, in many Bills gas companies were authorized to construct works; and it was necessary, in order to do this, to purchase bricks and other materials. If they were to be restricted from purchasing any materials except for the manufacture and supply of gas, it would have the result of preventing the Company from purchasing other materials which were absolutely essential for carrying on their business; and he was quite sure that the Committee did not mean that.

The CHAIRMAN: No, of course not.

Mr. FITZGERALD (on behalf of the United Alkali Manufacturers' Association) said these clauses did not carry out the decision of the Committee, and would enable the Gas Company to do the very thing that it was pointed out was objectionable, and which he presumed the Committee intended to exclude.

The CHAIRMAN; You have not agreed then.

Mr. FITZGERALD: No. Continuing, he said the Committee would remember that he put strongly before them, on behalf of the United Alkali Manufacturers' Association, their objection to what certain gas companies were doing, and what this Company could do unless restrained by a clause of some sort—namely, they were purchasing chemical materials which were not residual products at all, and using these materials for the manufacture of other chemicals, and entering into business as dealers in chemicals. As an illustration, he pointed out that they were purchasing sulphur and pyrites, and materials of this kind, and were manufacturing sulphuric acid in competition with the ordinary private manufacturers, quite independently of the question of working-up their own residuals. Under the clause which Mr. Lloyd had presented, the Company would be able to continue to do this. By leaving out the word "materials," or any similar words, they had confined the clause entirely to the purchase of residual products; and they could buy any materials which were not residual products. They could go into the market and buy anything they wished, and use the materials, not merely in conjunction with their own residual products, but use them separately for the manufacture of chemicals—the very thing which he understood the Committee intended to prevent. On the other hand, he had drawn up a clause exactly in the words of the Committee's decision, as follows:

> The South Suburban Gas Company shall not purchase materials other than those required for the manufacture and supply of gas by the South Suburban Company, except for the purpose of working-up their own residual products.

This enabled them to purchase any materials they thought fit, whether residual products or not, provided they were to be used in the manufacture and supply of gas, or in the working-up of their own residual products. Mr. Lloyd had raised the point that the including of the word "materials" might prevent them dealing in fittings or constructing works. Neither of these points, however, was in dispute or controversy before the Committee; and there was not the least intention on the part of the Alkali Manufacturers' Association to prevent gas companies from buying materials in this connection. To remove any such objection to the clause, he suggested the addition of the following words as a proviso:

> This restriction shall not apply to the purchase of fittings or materials therefor, or to the purchase of any materials required for the construction of gas-works.

With these words added, Mr. Lloyd's objection to the use of the word "materials" was entirely met; and the clause which he (Mr. Fitzgerald) had drawn up exactly carried out the decision announced by the Committee.

Mr. HONORATUS LLOYD said he had not been able to gather from Mr. Fitzgerald what it was his clause enabled the South Suburban Gas Company to do which the Committee had said they should not do. The governing words of the clause were "required for the manufacture or supply of gas by the South Suburban Company, or the conversion or working-up of residual products arising therefrom." Under these, his Company could buy chemicals for the purpose of working-up their own residuals; and he did not think the Committee wished to prevent him from doing this. If they were prevented, it would be inflicting a terrible hardship on the whole of the gas industry.

The CHAIRMAN: No, we do not. Supposing you put the words "chemical products" instead of the word "materials" in Mr. Fitzgerald's clause?

Mr. HONORATUS LLOYD said he was told by a well-known expert (Mr. Charles Carpenter) that the result of this would be to prevent them buying thorium and cerium, which were two metals necessary for the making of gas-mantles, nor could they buy nitrate of soda, which was essential for the purpose of making sulphuric acid. The wording of Mr. Fitzgerald was open to a very wide construction, and would absolutely prevent them from buying materials which were really necessary for carrying on their undertaking. He had thought that the real gist of the position was this—that it was the habit of some companies not only to work up their own residuals, but to buy the residuals of other gas companies, and so trade, not only in their own residuals, but in working-up the residuals of other people. He had drawn up his clause having this in view, and did not understand that the Committee desired to prevent them from buying chemicals for the purpose of working-up their own residuals.

Mr. FITZGERALD: My clause does not prevent you from doing that at all.

The CHAIRMAN: What is your objection, Mr. Lloyd, to Mr. Fitzgerald's suggestion?

Mr. HONORATUS LLOYD said that his clause provided that the Company were not to purchase residuals except for the purpose of the conversion or working-up the residual products arising from their own manufacture of gas; and, therefore, unless it was a residual product which he desired to buy for the purpose of working-up his own residual products, he could not buy it.

Mr. FITZGERALD said that surely there ought not to be any dispute about this. Mr. Lloyd's clause was limited to the purchase of residual products; but it did not prevent him in the least from purchasing any quantity of materials he liked which were not residual products, and then working them up into chemicals.

Mr. HONORATUS LLOYD said he joined issue at once with Mr. Fitzgerald on this point. He said his clause left him open to buy materials, except residual products, wherever he liked, so long as it was for the purpose of working-up his own residual products. This was the view he desired to impress upon the Committee; and he had thought that this was what the Committee had intended. If the Committee were to stop gas undertakings from purchasing materials for working-up their own residual products, they would stop half the gas industry.

The CHAIRMAN said the Committee would have to consider the matter, and take the opinion of the authorities of the House as to whether the clause carried out the Committee's decision.

Mr. HONORATUS LLOYD, in thanking the Chairman, said it was a most important matter, and one which none of them desired to see decided in a hurry. It was, he assured the Committee, much more than a mere question of words.

The CHAIRMAN: I do not know quite when we shall be able to give you a decision, because I should like to have before me, when considering it, the notes that are being taken at the present moment.

Mr. FITZGERALD asked, in connection with the word "materials," whether Mr. Lloyd wanted anything else than "materials" for fittings and the construction of gas-works.

Mr. HONORATUS LYOYD: I venture to suggest that it is not for you, appearing for the chemical trade, to prevent me buying materials of all sorts from all over the world.

Mr. FITZGERALD replied that he should have thought that words could very properly be added to make it quite clear that the clause would not apply to fittings for the construction of gas-works.

The Committee then adjourned.

ANNFIELD PLAIN AND DISTRICT GAS BILL.

In the case of the Annfield Plain and District Gas Bill (*ante*, pp. 818-820), the House of Commons Committee, while stating on Friday, March 15, that the preamble was proved, reserved their decision on the question of the petition by the United Alkali Manufacturers' Association. This also was given to-day.

Mr. BALFOUR BROWNE made application on behalf of the South Metropolitan Gas Company against alterations. He claimed his right under Standing Order No. 128.

Mr. KENNEDY (Parliamentary Agent for the United Alkali Manufacturers' Association) protested against Mr. Balfour Browne being heard. The Standing Order, he said, stated that petitioners could be heard while a Bill was in progress. In this case, the Committee had decided upon the preamble.

Mr. BALFOUR BROWNE argued that the clauses had still to be considered; and that was when he wished to be heard.

The CHAIRMAN said he thought the Standing Order hardly applied to this case; and the Committee were unanimously of opinion that they could not hear Mr. Balfour Browne.

The Committee then conferred with regard to the petition of the United Alkali Manufacturers' Association. After a short interval,

The CHAIRMAN (Sir Harry Samuel) said the Committee were unanimously of opinion that the Company ought not to be allowed to purchase materials other than those required for the manufacture and supply of gas, for any purpose except that of working-up their own residual products. But they were also strongly of opinion that there might be cases in which small companies should be permitted to join together for the purpose of rendering more effective their residual products, and that there might be in other cases special circumstances. Therefore they did not wish their decision to be taken as binding on all legislation of gas companies in the future. In this instance, he would ask Counsel to agree upon a clause which would carry into effect their decision that this Company should not be allowed to purchase materials other than those required for the manufacture and supply of gas, for any purpose except that of working-up their own residual products. That was the decision in this special case.

Mr. KENNEDY asked whether by "materials" the Committee meant those arising directly from the manufacture of gas.

The CHAIRMAN said it meant anything the Company might require for working-up in the most effective manner, and giving the best possible profit to the Gas Company.

Mr. KENNEDY: You mean residual products arising directly from the manufacture of their own gas?

The CHAIRMAN: Yes.

Mr. KENNEDY suggested that the promoters should draw up a clause and submit it, as in the case of the South Suburban Bill.

FLEETWOOD GAS BILL.

Mr. C. C. HUTCHINSON, K.C., intervened to say that he was promoting the Fleetwood Gas Bill, and exactly the same point arose there. He did not suppose the Committee's decision would be in any way varied from the one just given in regard to the Annfield Plain Bill; so that whatever clause was adopted, he presumed would go into both Bills. In this event, he should like an opportunity of discussing the wording of the clause. Might he suggest that the Committee should not discuss the clause until they came to the Fleetwood Bill?

The CHAIRMAN said this course would seem to be best.

Mr. BAILEY (for the promoters of the Annfield Plain Bill) intimated that he saw no objection.

FLEETWOOD GAS BILL.

HOUSE OF COMMONS COMMITTEE.—Tuesday, March 19.

(*Before Sir* HARRY SAMUEL, *Chairman, Sir* JOHN BARRAN, *Colonel* BATHURST, *and Mr.* DORIS.)

In this Bill, the promoters seek power to dissolve the Fleetwood Gas Company, Limited, and incorporate it as a statutory concern. Further capital powers are sought; and it is desired to alter the standard candle power and method of testing the gas, alter the standard price and sliding-scale, purchase additional lands, and break-up streets. Opposition was offered by the United Alkali Manufacturers' Association and the Urban District Council of Fleetwood.

Mr. C. C. HUTCHINSON, K.C., and Mr. KEEN appeared for the promoters; Mr. J. D. FITZGERALD, K.C., represented the United Alkali Manufacturers' Association; and Mr. VESEY KNOX, K.C., and Mr. COURTHOPE MUNRO the Urban District Council of Fleetwood.

Mr. HUTCHINSON, in opening the case for the Bill, said that the objects were to dissolve the present Fleetwood Gas Company, Limited, and to incorporate the Company as a statutory concern, to raise additional capital, create a special-purposes fund, and to alter the standard candle power and the method of testing, alter the standard price and sliding-scale, purchase additional lands, and break-up streets. It was proposed to raise an additional £30,000 capital, with borrowing powers of £10,000, and to preserve existing borrowing powers, amounting to £1700—making total new capital powers under the Bill of £41,700. The present capital consists of 8 per cent. and 7 per cent.; and it is proposed to consolidate the capital on the basis of a uniform 5 per cent. share capital, by allotting to the existing shareholders such amount of stock as will produce corresponding dividends. At present the standard price is 4s. 5d. per 1000 cubic feet. It is proposed to reduce this by 3d. per 1000 cubic feet, and to alter the wording of the sliding-scale so that, under the consolidation of the capital, there will be a variation of 1s. 3d. per cent. for every half year in the dividend for every penny, up or down, that the selling-price may differ from the new standard of 4s. 2d. In the present circumstances, the dividend payable under the consolidation scheme will be £8 8s. per cent.; the selling price being 3s. 6d. The illuminating power is to be reduced from 16 candles to 14 candles, and sanction was sought to the use of certain lands already in the Company's possession for erecting new works. With regard to the petition of the Alkali Manufacturers' Association, it was decided not to deal with this at present. It was stated, however, that the clause in the Bill was not a form of the Model Clause, and, if anything, gave less powers than the Model Clause. Similar clauses had been granted last year in the Cheshire and Sidmouth Bills, and in the case of Bishop's Stortford a few years ago. The petition of the Urban District Council stated that the capital powers sought were excessive, and that an insufficient amount was proposed to be raised by loan. As a matter of fact, the Company were asking the usual one-third borrowing powers; but if the Committee saw fit to increase this, there was no objection on his part. Another objection by the Council was to the stand-by clause, which included electricity as a stand-by supply. He was willing to meet the Council on this point, and delete the word electricity. As to the Council's objection to the powers to break-up streets, he would be content with the special clauses inserted last year in the Tamworth Bill. The Council also asked for a purchase clause; but they had not seen fit to promote a Bill themselves for this purpose.

Mr. *Samuel Shadbolt*, the Resident Manager and Secretary of the Company, said that at present only a small portion of Fleetwood was developed; and a very large increase was anticipated during the next 14 years in the way of slot meters, prepayment installations, &c. It was proposed to erect a new gasholder, because their existing storage only provided for 67·26 per cent. of present requirements. It was proposed to make the test with the "Metropolitan" burner, and so be brought into line with common practice.

Mr. VESEY KNOX, in cross-examination, pointed out that he raised no objection to the capital consolidation clauses. He elicited from witness that at present about 12 per cent. of the gas manufactured was used on the works and lost in leakage. Witness said that, whereas the present sales were 47,665,200 cubic feet, he had based his estimates on 100,000,000 cubic feet 15 years hence, which was a 5 per cent. compound increase. The Company proposed to practically remodel the works and erect new carbonizing plant; and an immediate expenditure of about £10,000 was contemplated. Cross-examination proceeded on the lines of endeavouring to show that, as the immediate expenditure was comparatively small, there was no need to have such a large increase of capital, and also that the normal rate of increase was not sufficient to justify the Company's proposals. Other questions were directed to showing that it would be uneconomical to extend upon the present site of the works, where there is no railway siding.

In answer to the CHAIRMAN, Mr. Vesey Knox admitted that he was putting these questions having in mind the wish of the Council to purchase the undertaking. Their view was that erecting new works in another part of the town was a better solution.

The CHAIRMAN, later on, put it to Mr. Knox that, in his desire to purchase now, he must not overlook the fact that the Company undertook the supply of gas in the district at a time when no one else would do it, and that it was hardly right for the Council now, seeing that the Company were prosperous, to wish to take it over. Further, the Council had not seen fit to bring in any Bill asking for powers to purchase.

Mr. VESEY KNOX replied that the Council were not aware until it was too late to take any action that the Company were coming to Parliament this session. As a matter of fact, the Council had always been anxious to take the works over; and negotiations had taken place some years ago with regard to this. Some recent negotiations had also taken place; but as they were without prejudice, he was not in a position to discuss them.

Witness was further cross-examined by Mr. KNOX, who suggested that a selling price of 3s. 6d. per 1000 cubic feet was much too high,

having in mind that the price in the neighbouring district of Lytham was 2s. Witness, however, replied that there were good reasons for this. There was no electric light competition there, and thus the gas supply was able to develop freely; the capital per million cubic feet was only £309, against £800 in Fleetwood; and the quantity supplied was nearly twice that in Fleetwood. Further questions were put to the witness suggesting that, instead of reducing the price to the consumer, larger sums than were allowed by the Company's Orders had been placed to reserve. Cross-examination was also directed to showing that if the gas-works were in the hands of the Council, who owned the electricity works, the management would be much more economical, as the same staff, to a large extent, would be used for the two undertakings. But the reply was that the undertakings would have to be managed quite separately. In connection with some questions put as to the success of the electric supply works, witness retorted that the concern was certainly successful; but one reason for this was the very cheap price at which the undertaking had been purchased from the old Electric Light Company when it was in the hands of the Liquidator. Further, since that time, the Council had even refused to allow the Gas Company to tender for the street lighting.

The *Managing-Director* of the Fleetwood Estates Company, who own a large portion of the undeveloped area of Fleetwood, and to which the Gas Company look for very considerable developments in the near future, also gave evidence in support of the Bill.

Wednesday, March 20.

Evidence in favour of the Bill was continued this morning.

Mr. *Bertram Drummond*, an architect and surveyor in Fleetwood, said as a ratepayer he disagreed with the purchase of the gas-works by the Council.

Mr. *H. E. Jones* agreed with the estimates and figures given by Mr. Shadbolt. The works were substantial and quite efficient, but much too crowded. On the question of the disadvantage of the works not having a railway siding, he said the cost of cartage due to this was 9d. per ton; but it was possible that the capital charges necessary to provide railway accommodation up to the works would more than counterbalance this extra cost.

In answer to a question by the CHAIRMAN, as to his experience of local authorities asking for compulsory purchase powers, witness stated these were not usually granted unless the company was badly mismanaged, which was not suggested in this instance. The new sliding-scale arrangement was such that for every £1 benefit to the shareholders a benefit of £4 3s. 4d. had to be given to the consumers. This, he said, was treating the consumers more than fairly. He saw no reason why the Company's business should be expropriated after 38 years' existence, during which time no complaints had been made against it.

Cross-examined by Mr. VESEY KNOX as to the high leakage loss—namely, 12 per cent.—witness said he did not think this unduly excessive. In any case, the local circumstances largely came into play.

The CHAIRMAN suggested to Mr. Vesey Knox that excessive leakage was rather a reflection upon the past management than upon the present, because it really was a question of how the mains were laid originally.

Questions were also put by various members of the Committee to elicit witness's views upon the prospects of the gas industry in the future in competition with electricity. He said that gas companies need have no fear, provided they could supply at about 3s. per 1000 cubic feet in small towns, 2s. 6d. in the larger towns, and lower in the very large towns.

Mr. *Thomas Popple*, the Vice-Chairman of the Company, said that letters had passed between the Council and the Company at various times upon the question of purchase; but the Company had never been willing to sell. Dealing with the suggested illegality in setting aside larger sums to reserve than they were authorized to do, witness claimed the right, under the Company's Order of 1884, to set aside a percentage to reserve each year which, upon the present financial position, would amount to about £200. It was true that in the last two years the sum of £2000 had been set aside; but as nothing had been transferred to reserve in previous years, this merely made up the deficiency.

Mr. COURTHOPE MUNRO said that the wording of the clause, in his opinion, only allowed the Company to set aside a certain sum in any one year, and not to make up past deficiencies. Consequently, his questions amounted to the argument that, instead of transferring this £2000 to reserve, some £1600 of it ought to have been distributed in dividends, and thus have reduced the price of gas to the consumer.

Witness: If this argument is correct, it is only a matter of book-keeping to put the position straight.

Cross-examined on the proposed purchase by the Council, witness reiterated that there had been no recent negotiations, and that the Company, having a good property, desired to keep it.

Mr. *R. G. Shadbolt* was called to corroborate the general proposals of the Bill.

This concluded the case for the Bill.

The case for the Urban District Council was then opened by the calling of

Mr. *J. Fleetwood Martinson*, for twenty years a member of the Urban District Council, and Chairman of the Finance Committee for fifteen years. He was taken in detail through the negotiations between the Council and the Company since 1874, with the view of showing the Committee that the Council had always been desirous of having the gas-works in their own hands, and that they had not taken this attitude for the first time in connection with this Bill. Witness also complained of the quality of the gas in Fleetwood; but from his evidence it was gathered he was still using flat-flame burners. He favoured the purchase of the gas-works by the Council, and suggested that, with this in view, extension upon the present site was undesirable. The present works were situated at one end of the district, while development was going on in the other direction, and therefore new works in a more central position should be erected.

Mr. *E. H. Stevenson* was the next witness. He stated that the new capital powers asked for were far in excess of the needs of the district, and, further, that in connection with the old capital the borrowing powers were too small—only amounting to about one-seventh. He suggested putting the borrowing powers of the old capital on the basis of one-third of the share capital, which would bring the unexhausted borrowing powers to £8400. In his opinion, £27,000 would be sufficient for the new capital; and deducting the £8400 of outstanding loan capital, this would bring it down to £18,600. He suggested, however, a new share capital of £15,000, with one-third borrowing powers, making £20,000, or £28,400 in all. One of his main reasons for reducing the capital in this way was that there was very little prospect of any need for prepayment installations. He made this statement on the strength of his experience in Yorkshire and Lancashire towns generally. In practically all the towns in these districts the landlords fitted the houses with gas-pipes while being built. Thus the gas companies were not put to the necessity of expending capital in this way; and he saw no reason why Fleetwood should be an exception.

The CHAIRMAN pointed out that in the Annfield Bill prepayment installations had been spoken of as a necessity.

Witness said it was so, because in that district it happened that the houses were not piped. In the majority of cases in Lancashire and Yorkshire, however, the houses were piped; and prepayment installations were not put in to anything like the same extent as in the south of England.

In answer to further questions from the COMMITTEE, witness admitted that he had not seen the Fleetwood works. He accepted Mr. Shadbolt's figure for the probable expansion in the next fifteen years, but nevertheless thought his own capital estimates sufficient.

In further examination witness said there were three cases where purchase clauses with resort to arbitration had been inserted. In two of these there had been no charge of bad management; but in the third instance there was. These cases were Redhill, City of Waterford, and Swinton and Mexborough. It was in connection with the latter that complaints were made as to bad management. He also mentioned four cases where suspensory powers had been given—namely, Merthyr, in 1906; East Hull, in 1906; Heckmondwike and Liversidge, in 1909; and Sidmouth, in 1911. In these Bills the capital powers could not be utilized for a certain period; so as to give the local authority an opportunity of purchase.

In cross-examination by Mr. KEEN, witness said he could not agree that the additions to the reserve fund were a mere matter of book-keeping. Counsel, however, pointed out that what had been done had not altered the operation of the sliding-scale in any way.

Thursday, March 21.

When the proceedings were resumed to-day,

Mr. FITZGERALD asked when it was proposed to discuss the clause relating to the alkali question. (*Ante*, p. 907.)

The CHAIRMAN said the Committee were waiting for the clause which they had asked the parties to agree.

Mr. FITZGERALD replied that they had not been able to agree.

After a short discussion, it was agreed to take the clause on both the Annfield Plain and Fleetwood Bills to-day (Tuesday.)

Further evidence was then given on behalf of the Fleetwood Urban District Council.

Mr. *A. Swarbrick*, a member of the Urban District Council, spoke as to the general feeling in the town, and on the part of the Council, having been always in favour of purchase. The difficulty seemed to be what was a fair price.

The CHAIRMAN thought the Council's appetite on the question of price seemed to have been whetted by their experience in purchasing the electricity works cheaply.

Witness, continuing his evidence, said that the case of a refusal to allow the Gas Company to tender for street lighting only referred to five lamps. It was the feeling of the Conncil that the Company would put in an unfairly low tender in order to get the lighting in question; and this might have placed them in the hands of the Company with respect to the future, as there would have been an unfair comparison between gas and electricity for street lighting.

The CHAIRMAN, intervening again, suggested that this was an argument against having the gas and electricity undertakings under the same control.

Witness was cross-examined to show that the Council had never seriously considered the question of purchase, and that it had never been discussed publicly in the Council. This was admitted, as was also the fact that no ratepayers' meeting had been held even to inform them that the Council were seeking a purchase clause now.

Mr. *G. M. Robertson*, the Chairman of the Electricity Committee and a member of the Sub-Committee appointed to deal with the Bill, also spoke of the unanimity of the Council as to the purchase.

Mr. *Gibson*, a ratepayer, gave evidence in general support of the proposal to purchase; stating that the gas was very bad and the price too high. The Railway Company, he said, had discarded gas owing to defective illumination.

In cross-examination, witness agreed that the Railway Company were still the largest gas consumers, and also that they still used flat-flame burners.

Mr. VESEY KNOX then addressed the Committee for the District Council. He argued that the capital powers asked for were excessive. This was important, because, if he were beaten on the question of purchase, this was the last chance, and for about twenty years he would be deprived of all opportunity of securing control of the works. It was very rarely that Parliament would grant compulsory purchase unless the company were at the end of their tether. Pontefract was the only case where compulsory powers were granted, and where there was no suggestion of bad management. As to the capital distribution, he asked the Committee not to increase the borrowing powers as was suggested, because it was conceivable that the Directors might prefer to issue shares rather than borrow money; and it might not be in the interests of the consumers that this should be done.

Mr. HUTCHINSON said that, so long as he got the aggregate amount of capital asked for in the Bill, he did not mind what proportion was shares and what proportion loan.

Mr. VESEY KNOX then went on the speak of the reserve fund.

The CHAIRMAN said he need not deal with this, as the Committee were unanimous that what had been done was illegal and would have to be put right.

Mr. VESEY KNOX, dealing in detail with the proposed purchase clause, suggested that it should provide for compulsory arbitration under the Lands Clauses Act, and that the Council should bring in a Bill in the next session of Parliament. The Council felt that it would be very desirable to erect new gas-works on the site of the existing electricity works. He thought the moment had come when they should regard a gas and electricity undertaking as supplementary and not as hostile competitors, and therefore they could be worked quite well in the hands of the Council.

Mr. HUTCHINSON replied for the Company, arguing that all the objections to capital, &c., were merely put in in order to lead up to the application for a purchase clause. He claimed that there was no precedent for granting rights of purchase to a local authority in circumstances such as obtained in this case, and asked the Committee to refuse the purchase clause.

After the room had been cleared for a short while,

The CHAIRMAN announced that the Committee were unanimously of the opinion that the preamble of the Bill was proved, subject to the question of clauses. In the first place, they were very strongly of opinion that the mistake made in connection with the reserve fund must be put straight; and this would be dealt with when the petition of the United Alkali Manufacturers' Association came up for discussion. Further, the Committee were of the opinion that one-third of the Company's capital, new and old, should be loan capital.

The Council thus do not get a purchase clause.

LEGAL INTELLIGENCE.

GAS MANAGER'S CLAIM FOR COMPENSATION.

The Court of Appeal (the Master of the Rolls and Lords Justices Fletcher Moulton and Buckley) was occupied last Thursday and Friday in hearing an appeal, nominally by the Brandon Gas Company, Limited, but in reality by the Employers' Liability Insurance Company, against a decision of his Honour Judge Mulligan, K.C., in the Norfolk County Court at Thetford, in favour of Mr. John Stinton, in a claim made by him for compensation for the loss of a leg. The previous proceedings have been reported in the "JOURNAL" [see *ante*, pp. 372, 463].

Mr. BAGGE appeared for the appellants; Mr. ELLISTON represented the respondent.

The applicant had been for a good many years in the service of the Gas Company as Working Manager, receiving a salary of 30s. a week, and a house in the yard, with fire and light, which was worth 8s. a week. On July 27, 1910, he was removing the lid from a retort when it fell on to his foot. He suffered considerable pain in his leg, which was at first attributed to rheumatism. In September, however, Dr. Harris, of Thetford, was called in; and he diagnosed gangrene in the foot, and advised the patient's removal to a hospital at Cambridge. The foot was first removed; and subsequently, on the 20th of December, the leg below the knee had to be amputated. On Jan. 11, 1911, the applicant sent a letter to the Chairman and Directors of the Company, narrating the circumstances and claiming compensation. The Company had paid him his full wages for some time after he was unable to work, then 20s. for a short time, and afterwards 10s. But when the claim for compensation under the Act was made, this was discontinued, and a defence was set up; the points raised being that the injury did not arise out of, and in the course of, the employment, and that notice of the accident was not given as required by the Act. The case came on for hearing on the 28th of November, when the Judge decided in favour of the applicant.

Mr. BAGGE read the evidence given in the County Court and commented upon it in some detail, in the endeavour to show that the injury was not caused by the fall of the retort-lid; Dr. Hicks, for instance, the House Surgeon at the hospital at Cambridge, having stated that Stinton did not mention anything about an accident. He also submitted, at some length, that the defendants had been prejudiced in their defence by the delay in giving notice of the accident.

Without calling on Mr. Elliston,

The MASTER OF THE ROLLS said the case had been argued with great courage by Mr. Bagge, but he had not satisfied him that there was any single point in the very careful judgment of Judge Mulligan which was in any way incorrect, or which could in any way be improved upon. The appeal must therefore be dismissed, with costs.

Lords Justices MOULTON and BUCKLEY concurred.

THE HEATHFIELD NATURAL GAS SCHEME.

Directors' Fined for Non-Compliance with the Companies (Consolidation) Act, 1908.

At the Hailsham Petty Sessions, last Wednesday, Captain Fred Jenkins and Mr. Daniel Wallace Heims were summoned, as Directors of the South of England Natural Gas and Petroleum Company, for two offences under the Companies (Consolidation) Act of 1908.

Mr. A. J. HART (Messrs. Hart, Reade, and Co.) appeared to prosecute on behalf of the Solicitors to the Board of Trade; the defendants were not legally represented.

Mr. HART, in opening the case, stated that the Act of 1908 provided that failure to call a meeting of shareholders in every calendar year rendered every director liable to a penalty not exceeding £50. The second offence alleged was failure to prepare a list of shareholders within fourteen days of the general meeting; the penalty for non-compliance being a continuous one of £5 per day. The present Company had received from the public £4324. They issued no less than three prospectuses within fifteen months, and each time drew a little money from the public. Within three months of March, 1910, there should have been a statutory general meeting of the shareholders to receive a report as to the issue of shares and other matters; but the meeting had never been called. The consequence was that the Board of Trade had received letters of complaint from various shareholders. They had applied to the Company for explanations as to why meetings had not been called, and promises had been made from time to time; but thus far nothing had been done.

Witnesses having been called to prove that no notices of meetings had been sent to the shareholders,

Mr. *Heims*, in defence, said the Company was floated by a promoter, and commenced operations with hardly enough money to pay the costs of promotion, and he was left with a debt of £600. He had done his best to call a meeting. He was the pioneer of natural gas and petroleum in Sussex, and he had great faith in the scheme, which was now left on his shoulders. It would be useless to inflict a heavy penalty, as he had no money with which to pay. The file would be sent to the Board of Trade, and they would have a general meeting of shareholders within a fortnight.

Captain *Jenkins* said he had practically nothing to do with the concern. He had left the whole management to Mr. Heims, who, he thought, had done the best he could. Moreover, he (Captain Jenkins) had spent money out of his own pocket in order to ballast up the concern. Why was not the Company wound-up? The Directors had been working for nothing.

The Justices retired to consider their decision. On their return,

The CHAIRMAN (Dr. Jeffery) said that for the first offence each defendant would be fined £25 and half the costs, so that each would have to pay £39 11s. 2d.; for the second offence, £25 and 6s. 6d. costs—making £64 17s. 8d. each. In default, each would suffer two months' imprisonment.

Defendants were allowed a month in which to pay.

ALLEGED NEGLIGENCE OF A GAS INSPECTOR.

Failure of the Claim against the Manchester Corporation.

At the Manchester Assizes last Friday, Mr. Justice Bray heard legal arguments as to the effect of the Jury's findings in an action tried by him on the 27th ult., when a tramwayman named Bertram Forsyth claimed damages from the Manchester Corporation for injuries caused to his four-year-old son through the alleged negligence of a gas inspector in their service. The proceedings at the trial were reported in the "JOURNAL" for the 5th inst. (p. 675). The case in support of the claim was that a gas inspector named Ford, in repairing a prepayment gas-meter at the plaintiff's house, left an open penknife, and that the child, getting hold of it, so injured one of his eyes that it had to be removed. For the defence it was argued that the repair of prepayment gas-meters did not come within the scope of Ford's duties, there being special men for the purpose; that Ford went to look at the meter at the request of a neighbour of the plaintiff; and that the accident was really due to, or contributed to by, the want of supervision of the child. The Jury found in effect that the accident was brought about by negligence on the part of Ford; that there was not contributory negligence on the part of those in charge of the child; that the accident was not such as Ford might have anticipated; and that Ford attended to the meter on behalf of the Corporation. They awarded £125 damages.

Mr. LANGDON, K.C., submitted that the Jury's findings amounted to a verdict for the plaintiff, because they found that there had been negligence on the part of Ford, and that this occurred in the course of his employment as a servant of the Corporation.

Without calling upon Dr. Atkinson, for the Corporation,

Mr. Justice BRAY said there must be judgment for the Corporation. Two points had been raised. One was whether he should hold that the Jury had found that there was negligence; and the other was whether there was evidence to support the finding of the Jury that the act of Ford was done in the course of his employment. Dealing with the last point first, as the most important, his Lordship said it was quite clear that the gas inspector had not been sent by the Corporation to do any work at the house of the plaintiff; and therefore it was for him to show that Ford was within his authority to do something which he was not sent to do. There was no evidence to support this, except that Ford wore a uniform bearing letters showing that he was an inspector. But the Corporation went further, and called evidence to prove that Ford had no right to touch the meter—his duties being simply to inspect houses which had been empty; and he was not even furnished with tools. It had been argued that Ford was acting for the Corporation's benefit. But this was not sufficient. It seemed to him that there was no evidence on which the Jury could find that the inspector was acting in the course of his authority. It was said that the two chief findings of the Jury were inconsistent; but as they had found that the accident was not one which Ford could have reasonably anticipated, there could be no breach of duty by him, and therefore no evidence of negligence. Plaintiff's claim, therefore failed; and there would accordingly be judgment for the Corporation.

Gas Companies' Employees as Territorials.—The Directors of the Yorktown and Blackwater Gas Company are offering special facilities to the younger men in their employ to join the Territorial Force. The Company have recently decided to recognize the work of all the employees by giving them a bonus of 5 per cent. on their wages during the present year; and to celebrate the introduction of this scheme, the Directors recently entertained the whole of the workmen at dinner. During the evening, Mr. David Sparvell, the Chairman of the Company, who presided, said that, if any of the young workmen cared to join the Territorials, he could assure them that they would not lose money by it; for while they were at camp the Directors would make up to them the usual wages which they would receive if at work.

MISCELLANEOUS NEWS.

STIMULATING GAS CONSUMPTION IN EDINBURGH.

Free Gas-Cookers and Concessions to Prepayment Consumers.

It may be remembered that about the middle of November last the Gas Commissioners of the Edinburgh and Leith Corporations remitted to Mr. W. R. Herring (the Consulting Engineer), Mr. A. Masterton (the Engineer and Manager), and Mr. A. Canning Williams (the Treasurer and Collector) to consider and report upon, separately and independently, the position of the gas undertaking, as disclosed by the accounts of the Commissioners during the past few years, particularly in regard to the falling-off in consumption and revenue, and to offer suggestions as to the means by which an increased use of gas might be obtained, and as to how the financial position of the undertaking might be improved. In due course, the gentlemen named made their reports, and they have been noticed in the "JOURNAL" [see *ante*, pp. 310, 450].

At the meeting of the Commissioners on the 29th of January, they had before them the interim report of the Sub-Committee appointed to deal with this matter. Having considered the reports above referred to, together with a *précis* of the suggestions contained therein, the Sub-Committee resolved upon a series of recommendations. With regard to gas-cookers, they decided to recommend the Commissioners to offer to let them out at the annual rent of 2½ per cent. on the cost (the cookers to be fitted free), and with a guaranteed consumption by the hirer to be subsequently adjusted. As to gas-fires, they resolved to recommend that the Commissioners should let them out on the three years' hire-purchase system, as was recommended by Mr. Masterton; but that, in computing the hire rates, 10 per cent. be added to the purchase price, instead of 20 per cent. as proposed. With respect to prepayment consumers, the Sub-Committee decided to recommend that the Commissioners should discontinue the graduated rebate system based on the annual consumption of gas, and should charge 10d. per 1000 cubic feet beyond the ordinary lighting rate for gas used through these meters. The recommendations were all remitted back to the Committee for further consideration; and they were duly passed to the Sub-Committee, who considered them, with the following results: With regard to gas-cookers, &c., they resolved to recommend that the Commissioners should offer to supply and fit them up by their own workmen free of all charges to the consumers, who should guarantee a consumption to be subsequently adjusted. With respect to gas-fires, in addition to their former recommendation, they resolved to recommend that the fitting-up should be done either by the Commissioners' workpeople or by the trade, as might be subsequently arranged. As to prepayment consumers, a member of the Sub-Committee who had dissented from the recommendation to charge 10d. net per 1000 cubic feet beyond the ordinary price, moved that the figure should be 7d. Another member proposed that it should be 8d.; and this was the figure recommended by the Sub-Committee. The Engineer and Manager was instructed to add to his previous report particulars as to Perth, Dundee, Aberdeen, and other places in Scotland, with a note of the extra price charged in these places for gas supplied through prepayment meters, and details in connection therewith. At the same meeting, the Sub-Committee considered letters received from the Edinburgh and Leith Master Plumbers' Association, the Ironmongers' Federated Association (Edinburgh, Leith, and District Branch), and the Edinburgh and Leith Operative Plumbers' Association as to the proposals of the Commissioners for increasing the consumption of gas; and it was resolved to recommend that the Commissioners should agree to the Sub-Committee having a meeting with these organizations to discuss matters. This was held on the 23rd ult.; and a report of the interview was presented by the Engineer and Manager, together with his replies to the most important questions raised, and a series of suggestions for arrangements between the Commissioners and the traders which he considered might be of service to the Committee in arriving at a mutual and friendly understanding with the trade. He also submitted memoranda for the guidance of architects, surveyors, builders, plumbers, and others regulating the diameters and lengths of pipes and fittings required for the efficient supply of gas to new houses, buildings, and other properties; and, as requested, a tabular statement showing the extra prices charged to prepayment consumers in various Scottish towns.

The Sub-Committee had another meeting on the 4th inst., when they further considered their several reports and recommendations, together with the documents above referred to, and resolved to suggest the following alterations to the recommendations: "(1) As to gas-cookers, that no guarantee of consumption should be required, but that the Commissioners should reserve the right to remove any cookers in their opinion not consuming a sufficient quantity of gas. (2) As to gas-fires, that the fitting-up and maintaining of the work for one year should be attended to by local tradesmen at schedule rates to be adjusted, and that the consumers should be entitled to hire, hire-purchase, or buy fires, on terms to be fixed later. (3) As to ordinary gas lighting, that no alterations should be made on the present conditions."

The agreement embodying the terms on which gas-cookers will be lent by the Commissioners contains the following clauses:

> The consumer, in accepting the appliance, undertakes to keep it in regular and proper use for a period of not less than twelve consecutive months. Should the appliance be removed earlier, at the request of the consumer, or through neglect or improper use, the consumer must pay the cost of materials and labour employed in connecting, fitting, and removing. If the position of the appliance should, at the consumer's request, be altered, he or she will bear the cost of such alteration. If it be found that the cooker is not sufficiently used, or is improperly used or neglected, the Commissioners reserve the right to remove it after due notice has been given, and to charge the cost of fitting and removal, if this should occur within the twelve months above mentioned.

At the statutory meeting of the Gas Commissioners on Monday last week, Bailie Lindsay, as Convener of the Finance and Law Committee, submitted the several recommendations. He said it had been agreed to grant the free use of gas-cookers, and to fit them free to approved consumers. Secondly, with regard to gas-fires, the decision was come to that the fitting-up and maintaining of this work for one year should be attended to by local tradesmen, or (at the request of private consumers) by the Gas Commissioners, at scheduled rates to be adjusted; and that consumers should be entitled to hire, hire-purchase, or buy at once the fires, on terms to be fixed later. The Committee remitted to a Sub-Committee to meet with the trade and mutually agree upon a schedule of rates. It was also agreed that these rates should come into force on May 15 next. As to ordinary gas lighting, no alteration was made on the present conditions. With regard to slot meters, however, the Committee resolved to make a differential rate between the ordinary consumer and the prepayment consumer of 7d. per 1000 cubic feet. The former price was 1s. 2d. extra per 1000 cubic feet, subject to rebates according to the annual consumption. The average, after deducting the rebates, worked out at 11½d. per 1000 cubic feet. These discounts or rebates would be done away with entirely, and a permanent differential rate of 7d. imposed on all prepayment meter consumers over the ordinary rate. With regard to the reason for the extra 7d., they had been advised in former times by Mr. Herring, and re-advised lately by Mr. Masterton, that the sum mentioned did not meet the full extra cost. Mr. Herring advised them that it amounted to something more like 1s. per 1000 cubic feet. But the Commissioners, with an earnest desire to increase the consumption of gas through slot meters, and to be as reasonable as possible to the small consumers, had fixed the point of 7d. The recommendations were unanimously approved.

EDINBURGH AND LEITH GAS COMMISSIONERS.

Annual Dinner.

The Annual Dinner of the Edinburgh and Leith Corporations' Gas Commissioners was held last Wednesday, in the North British Station Hotel, Edinburgh. Sir W. S. BROWN, Lord Provost of Edinburgh, occupied the chair. The company numbered about 120, and included, among others, Mr. W. R. Herring, the Consulting Engineer to the Commissioners, and Mr. Alex. Wilson, the Gas Engineer to the Corporation of Glasgow.

Sir JOHN M. CLARK, Bart., Master of the Edinburgh Merchant Company, proposed the toast of "The Gas Commissioners." In doing so, he argued that it was in the interests of both communities that such an undertaking should be administered by a joint board, rather than by private syndicates. He recalled with pride the fact that his father was Lord Provost of Edinburgh in 1888, at the time when the Commission was formed by the amalgamation of the Edinburgh Gas Company and the Edinburgh and Leith Gaslight Company. His signature stood first in the agreement; and he was first Chairman. In a reference to the reduction in the price of gas since those days, he expressed the hope that the price would not be further reduced at the expense of the quality. They were all justly proud of the gas-works at Granton, which he believed to be second to none in the United Kingdom. In concluding, he extended sympathy to the Gas Commissioners in the trouble they must be experiencing in connection with the miners' strike. Speaking generally, many employees nowadays did their work heartily; but there were others who tried to get as little work into the time as possible. If these men would put their backs into their work, the question of the minimum wage would settle itself.

Bailie LINDSAY, the Convener of the Finance and Law Committee, in the course of his reply, said that since the Commissioners came into office, the price of gas had (with slight fluctuations, occasioned principally by causes beyond their control) been reduced from 3s. 6d. to 2s. 8d. per 1000 cubic feet, with a special rate at the present time of 2s. 3d. per 1000 feet for public lighting and power and trade purposes. This reduction, too, had been achieved notwithstanding the fact that the wages of the various employees had been steadily advanced, and that the conditions of employment, so far as holidays and superannuation, &c., were concerned, had been placed on a basis which would compare favourably with any body of similar workers in the kingdom. The quantity of gas sold in the last financial year was 1895 million cubic feet; and the concern ranked seventeenth in the gas undertakings of the United Kingdom. The total annual receipts on revenue account amounted to about £340,000. The exceptionally hot weather of last summer had a very marked effect upon the consumption of gas; but the decrease which then occurred was carefully noted by the Commissioners, and they forthwith called for individual and independent reports from the General Manager (Mr. A. Masterton), the Treasurer (Mr. A. C. Williams), and the Consulting Engineer, as to what means they could suggest for increasing the consumption. These reports were duly received. One suggestion common to the three reports was that the Commissioners should endeavour to secure an increase in what was termed the "day-load." With this end in view, after giving the various suggestions the fullest consideration, the Commissioners, at their meeting on Monday, had finally decided to offer to the public: (1) Gas cookers free of charge, and likewise free of any expense for fitting. In this particular step they were following the example of Manchester, Glasgow, Dundee, Paisley, Aberdeen, and Perth, where large and rapid increases in the consumption of gas, with corresponding reduction in price, had shown the wisdom of this step. (2) Gas-fires and other heating appliances of certain standard sizes would be hired-out on the simple hire system, or hire-purchase system, or sold outright on the lowest possible terms. The Commissioners had also decided to supply gas by prepayment meter at a net difference of 7d. per 1000 cubic feet above the price charged to ordinary consumers, as against a present difference of 1s. 2d., subject to rebates. On these new terms, which would come into operation as at May 15, the Commissioners hoped that a very large number of cooking and heating appliances would be introduced into Edinburgh. To advertise these facts, and to popularize the different cooking and heating appliances, the Commissioners had arranged for exhibitions, along with demon-

strations by trained lecturers, to be given throughout the various districts of the city, and arrangements were also being completed for an exhibition of gas appliances in the Waverley Market in the autumn of this year. The opening exhibition, held in Leith, was an unqualified success—upwards of 1500 people attended. In concluding, he referred to the gratifying position occupied by the Commissioners at present with regard to the coal strike. Owing principally to the forethought of their previous General Manager, they had in reserve when the strike commenced a supply of coal equal to about three months' requirements. The Commissioners had, as gas producers, thus been able to view the situation with a calm mind; and he had reason to believe that, owing to the supply of coke which was available at Granton, the minds of many traders in the city and burgh had been greatly relieved.

GERMAN CONTINENTAL GAS COMPANY.

Annual Report and Accounts.

Herr W. von Oechelhaeuser, the General Manager, has forwarded us a copy of the report and statement of accounts for the past year which are to be submitted to the general meeting of the German Continental Gas Company on the 29th inst.

The past year can be put down as far and away the best the Company has ever enjoyed. In spite of the loss of the gas-works at Erfurt, which at the beginning of 1911 were sold to the town authorities, the increase in the consumption of gas amounted to some 293 million cubic feet—that is, 2·17 per cent. increase on the previous year, or 10·5 per cent. increase, making allowance for the loss of Erfurt.

The total profit on the year's working, including all branches of the Company, amounted to 4,337,749 marks (£212,635); and this notwithstanding the loss of Erfurt, with its profit last year of 699,993 marks (£34,019). It is proposed to pay a dividend of 11 per cent., as against 9 per cent. last year. These good results are in large measure due to various changes in organization and working lately introduced, and to the energy inspired by newly-appointed members of the staff.

Though prices for coke remained low, tar and ammonia showed some improvement. Trouble was experienced in the hot summer, as English coal could not be brought up the Elbe and the Oder in boats; consequently, the more expensive German coal had to be brought by rail at higher freightage. Automatic prepayment meters played a considerable part in the increased sale of gas; 19 per cent. more being in use than in the previous year.

Vertical retort-settings have been extended with the most satisfactory results at the works at Dessau, Potsdam, Frankfort-on-Oder, Bismarckhütte, Upper Silesia, Warsaw, Elbgau, Gotha, and M.-Gladbach, and are to be introduced this year at Nordhausen and Luckenwalde.

Extensions are to be made in the near future in Alsace and Loraine, where a foothold has been obtained by the purchase of the small gas-works at Barr, in the neighbourhood of Strassburg. Several concessions have already been obtained, and others are under discussion at the present moment. For the small outlying districts here, high-pressure gas will be supplied for the first time by the Company.

Contracts for the supply of electrical current have been signed by the Company in various parts, including Bernburg, Cöthen, and the outlying townships of Potsdam and Dessau. Extensions were made at the electrical works of the last-mentioned town, which celebrated their 25th anniversary this year. At this station, the sale of gas showed an increase of 19·4 per cent., and that of electricity an increase of 10·4 per cent.—an interesting example of the progress side by side of these two sources of energy.

In January, the new gas-works at Frankfort-on-Oder were brought into operation; and as they are capable of supplying the whole district from their vertical retort-settings, the old works are kept in reserve. The ground purchased for building a second new works is used as a meter station.

Extensions at the Elbgau station will be necessary in the current year. Progress in the Upper Silesian district has been excellent, in spite of the competition of the well-established municipal electricity works. New contracts have been made with three outlying townships for periods of forty years. The increasing use of gas for heating purposes in the iron-works of this industrial centre is a cause of great satisfaction.

The Company's head factory had to deal with an increased demand for meters, and heating and cooking stoves. Improvements in the already patented Askania apparatus have solved the long-standing problem of how to light or extinguish a gas-flame from any desired spot by merely moving a small lever, as with electric light.

The Company have associated themselves with the Mark Electricity Company in Hagen, having bought shares of the nominal value of 200,000 marks (£10,000); half the sum having been paid down. The negotiations opened with the town of Rheydt at the close of last year have ended with the uniting of the Company's gas-works in that district with the Municipal electricity works under the name of the Lower Rhine Light and Power Works. These are only two examples of the general tendency in Germany at the present time for small concerns to join hands and avoid unnecessary competition.

The pension, widow, and orphan fund of the staff shows an increase both in subscribers and in funds, and has been put on an efficient working basis by a gift from the Company of 150,000 marks (£7500).

It is proposed to issue this year new shares of the nominal value of £150,000, to cover the cost of the many extensions rendered necessary by the increased demand for gas.

On the 1st of May of the current year, General Director Dr.ing W. von Oechelhaeuser will retire from the management of the Company, which position he has occupied since Jan. 1, 1890. He has been in the service of the Company in all thirty-one years. The extent and success of his work are evident, when it is stated that the amount invested in shares of the Company has increased by 87·5 per cent., the fixed capital by 160 per cent., and the general reserve and extension funds by 800 per cent. since the year 1890. The output of gas has risen from 32 to 87½ million cubic metres in the same period.

COAL STRIKE AND GAS SUPPLY.

Economizing Gas.

The continuance of the strike of coal miners has necessitated the adoption of further measures to economize as much as possible the gas which can be produced from the stocks of coal available. An idea of the position in various parts of the country may be formed from what appears below.

The Birmingham Gas Committee, at a special meeting, decided to issue a circular informing the consumers that the stocks of coal were being reduced by more than 10,000 tons a week, and impressing upon them the necessity of exercising economy in the use of gas. It was felt that the reduction of 7000 made in the number of street-lamps lighted was not sufficient, and that further lights would have to be cut off.

The Gas Company at Halesowen (where the public lighting has already been curtailed) last Tuesday issued the following notice to the consumers: "Owing to the continued coal strike, the Directors find it will be necessary to restrict the supply of gas. May we ask your kind indulgence to curtail the use as far as possible—especially gas-engine users—and shopkeepers to endeavour to close their shops one hour earlier than the usual time. This will help us to prolong our stock of coal for gas supplies. If this is not done by some voluntary method, we are afraid that the supply will be cut off altogether in less than fourteen days."

At Leeds, the Gas Committee of the Corporation met last Thursday to consider how best to deal with the situation; and they decided to meet again on Monday (yesterday). Meanwhile, it was decided to cut off the gas supply as follows: Saturday, from 6 a.m. to 6 p.m.; Sunday, from 6 a.m. to 6 p.m.; and Monday, from 1 p.m. to 6 p.m. All consumers are urged to see that their taps are turned off during the period mentioned. The Street Lighting Committee met on the same day, and resolved that the public lamps should be lit two hours later and extinguished two hours earlier than usual. The number of lamps lit had already been reduced one-half.

A request having been made at Maryport that the evening services in the places of worship should be given up, in order to economize the gas consumption, the Vicar suggested that the Council might find less useful places to close first. He also wrote that "there was no sense of proportion" in asking them to abandon the evening service while there was no curtailment in the hours of the public-houses and the places of amusement. It was, however, pointed out in the District Council that the public-houses could not close earlier.

At a meeting of the City Lighting Committee of the Newcastle Corporation, a report was submitted with reference to the partial lighting of the city, owing to the continuance of the labour disputes. It was pointed out, though the reduction had commenced on March 5, there had been practically no complaints received from the public. This was considered very satisfactory, inasmuch as the reduction had extended to 46 per cent. of the total number of lamps.

An appeal has been made to the Skipton consumers by Mr. W. Graham, the Chairman of the Gas Committee, to exercise all possible economy in the use of gas; and he urges those responsible for gatherings in churches and chapels to hold them as far as possible in the daytime.

The Stockport Gas Committee have decided to further reduce the pressure of gas between 11 p.m. and 8 a.m., and to issue a warning that gas-taps should be turned off between those hours. None of the lamps are being lighted in the side streets; and in others, only alternate ones are used—all being turned out at midnight.

At Worthing, the Gas Company are restricting their gas supply to certain hours of the day when it is most needed for cooking and lighting purposes. It is cut off during the night; and the Town Council have been asked to curtail the public lighting by gas as much as possible.

The public lighting has been curtailed by using alternate lamps only, leaving those in back streets unlighted, and extinguishing earlier, or has been stopped entirely, in the following, among other, places: Atherton, Barnsley, Barry, Biggleswade, Bolton, Brackley, Bristol, Burley-in-Wharfedale, Burnley, Bury, Chard, Chesterfield, Derby, Doncaster, East Grinstead, Heywood, Hyde, Morecambe, Mossley, Nelson, Oldham, Otley, Rochdale, St. Asaph, Sheffield, and Uttoxeter.

With the view of husbanding his stock of coal, Mr. A. R. Wyatt, the Manager of the Seaton Gas-Works, is utilizing his tar for the production of gas; and he hopes to maintain an efficient supply of gas for public and private lighting for some weeks to come.

Councils as Retailers of Coal.

A curious position has arisen at Bollington, in Cheshire. The District Council, having a large stock of coal at the gas-works, decided to retail part of it, leaving sufficient to cover ordinary requirements at the works for about two months. Ratepayers in the Council's district became entitled to 2 cwt. per week at 1s. per cwt. until the surplus stock was exhausted; and a number of private firms were also supplied. At the District Council meeting, considerable discussion took place as to the disposal of coal from the gas-works to the Macclesfield Co-operative Society for sale in Bollington, and to two private firms. It was explained, in regard to the latter, that this supply of fuel by the Council had enabled the firms in question to continue industrial operations, to the consequent advantage of the ratepayers. The sale to the Co-operative Society was, however, regarded as an indiscretion; and a minute to this effect was passed. The local coal dealers entered a protest against the Council retailing coal; and there has been talk of an application being made for an injunction to stop the practice.

The Oswaldtwistle District Council, having on hand a very large quantity of coal at the gas-works, have decided to sell 180 tons at 33s. a ton to local millowners, so that the factories may be kept running a little longer.

The Great Demand for Coke.

So great has been the demand for coke in some northern towns, that in practically all cases surplus stocks at the gas-works have now been

exhausted, and supplies to the public are very much limited or stopped altogether, because of the daily make of coke being required for the water-gas plant.

Recognizing the needs of the poorer customers, the Birmingham Gas Committee have decided to continue sales of coke at the works in quantities not exceeding ½ cwt.; and provision will also be made to meet the requirements of bakers and other food suppliers and public institutions.

Mr. J. Chew, the Manager of the Blackpool Gas-Works, has issued a notice that sales of coke will be confined to Blackpool people.

The Bolton Gas Committee, having disposed of all surplus stocks of coke, have notified the public that they can now only ensure supplies in small quantities to very poor people of the town, who must produce a ticket from one of the local charitable institutions.

The Gas Committee at Halifax have decided to discontinue supplying coke to private consumers, except bakers and similar tradesmen, so that, should the coal supply unfortunately run low, there may be coke enough to ensure a supply of water gas.

The Haslingden Gas Company resolutely refuse to sell to people outside the town; and large crowds besiege the works daily, waiting for the coke as it comes from the retorts.

At Manchester, the Gas Committee of the Corporation are still selling coke in half-hundredweights to the very poor people at 3d. In fact, consumers have been getting nearer 70 lbs. than 56 lbs. for their money. It is estimated that up to Saturday the Corporation had supplied over 2000 tons of coke to poor people in this way. As much as 215 tons were disposed of on one day last week; and it is calculated that, as the Gas Committee could have sold the coke at £1 per ton, the department have sacrificed over £1000 so that the very poor people should benefit. As to the sale of larger quantities, the department give preference to the elementary schools, the public wash-houses, and the public bakeries.

The Padiham Council have issued a notice to the effect that they are charging ordinary prices for coke at the gas-works, and that if any dealer is found charging more he will not receive further supplies.

The Preston Gas Company give preference to the local school authorities, so that the heating apparatus can be kept going; and also to the bakeries.

Last Friday, the Gas Committee of the Stockport Corporation issued a notice that no further coke will be available at the gas-works, even for poor people; it being all required for the water-gas plant.

MUNICIPAL WORKERS AND THEIR DEMANDS.

The Strike Fiasco at Salford.

The Salford Branch of the Municipal Workers' Union have fared very badly as the result of their last tilt with the Corporation. The strike turned out a complete fiasco. Many of the men have not been re-engaged; and an attempt to enlist the sympathies of the delegates to the Manchester and Salford Trades Council with a view to bringing about a general strike involving all trades has failed. The firm handling of the situation by the Committees concerned, led by the Mayor (Alderman Linsley) and Alderman Phillips, the Chairman of the Gas Committee, has the warm approval of the great majority of the residents in the borough and out of it.

As stated in last week's "JOURNAL," the few hundred men who struck work because of the alleged victimization of seven men in the Gas Department, in consequence of the active part they played in the previous strike, agreed, but with reluctance, to at once resume work, as recommended by their leaders. This was on the Saturday night, and after the men had been on strike just 24 hours, and had failed to get the workers in other departments to join in the movement. There was a surprise in store for the men, however, on presenting themselves for duty. They were informed that, having ceased work without proper notice, and without reasonable cause, their posts were considered vacant, and would be filled in the ordinary way. There was then a rush for work; and on Monday morning there were something like 1000 applications for employment, including the 300 and more men who struck work the previous Friday night. The filling of the different positions was relegated to a Sub-Committee, who included Alderman Phillips. On the Monday afternoon, the Sub-Committee visited the Wilburn Street depôt to deal with a large number of applicants for work assembled there. Here 30 lamplighters who had been on strike attended, and made application to be allowed to resume work. The Sub-Committee decided to permit 28 of them to do so; but the other two were told they must find employment elsewhere. Other depôts were visited subsequently, and many of the vacancies filled; other applicants being told they would be advised in the event of their services being required. Included among the hands engaged are a considerable number of those who struck work. They said they were misled, and had been intimidated. Following the drastic action of the Corporation, the leaders of the men issued a handbill in the borough appealing for the support of trade unionists and the ratepayers in the present struggle—declaring that the steps taken by the Corporation were a direct blow at trade unionism. There were also processions of discontented municipal workers in the evening; but no disturbances took place.

The next move on the part of the Union was to invoke the aid of the Manchester and Salford Trades' Council, which met on Tuesday evening. The subject was introduced as a matter of urgency; but the decision to consider a resolution dealing with it was only carried by 63 votes to 55. This resolution, having expressed sympathy with the men who struck work to secure the re-instatement of the men alleged to have been victimized, read as follows: "The action of the Committees concerned in discharging the whole of the men on strike and demanding their personal application for re-instatement, was a direct infringement of the right of the men to have their case put by their responsible representatives." In the course of the discussion, several speakers declared that the whole business had been mismanaged; and it was also pointed out that the Union, which claimed to have a membership of over 1000 in the borough, only succeeded in bringing out between 300 and 400. After a good deal of discussion, the "previous question" was moved and adopted, and the meeting broke up.

Notices have been posted at the Corporation depôts stating that men leaving their work without a written statement as to the cause of their absence will be deemed to have left the Corporation employ, and their places will be filled by others. One member of the Town Council stated that the Corporation were determined to put a stop to their employees leaving work in the way they had done recently.

In the course of an interview, Alderman Phillips said he desired to make it quite clear that there had been no strike in the gas-works; the departments chiefly concerned being the lighting and the cleansing. Not one man in the works had been out; and of the four men in subordinate positions who struck work, two would be very glad to get back if they could. "The attitude which the management of the gas-works and myself have for a great number of years observed," added the Alderman, "is to take no account whatever as to whether the men are trade unionists or not. We hold that is no business of ours. So long as they do their duty to us in the works, it is a matter upon which they must decide for themselves, and of their own free will. The charge of victimization was heard first from Councillor J. T. Jones, the men's Secretary; but he had absolutely no evidence to offer me in support of his contention. Both the Mayor and myself have thoroughly investigated these alleged cases of victimization, and have satisfied ourselves that they are absolutely without foundation. It should be remembered, in connection with the gas undertaking, that as the days become longer the quantity of gas consumed becomes less, and as a consequence fewer men are required; so it becomes necessary to dispense with the services of some of them. The present unusual slackness in the mains and services departments—due in some measure to the coal strike—has compelled us to weed out some of the out-door men, and they are sent away because there is nothing for them to do. We are told that some influential members of the Corporation have pledged themselves to an inquiry; but nobody seems to know anything about this pledge inside the Corporation. The management of the gas undertaking have for many years past worked in unbroken amity with the men; and it is not likely they would imperil these good relations in a fit of petulance."

No Advance at Leigh.

The Leigh Town Council sat till a late hour on Tuesday night; a considerable part of the time being occupied in discussing the wages question. Representatives of the Labour Party brought forward a resolution that the minimum rate of wages for employees under the Corporation be increased from 25s. to 27s. per week. Those who were opposed to the proposition argued that many of the small shopkeepers were on the verge of bankruptcy, and could not pay the existing rates. Further, it was pointed out that there was not a joiner or an ordinary bricklayer in Leigh who averaged 27s. a week the year round. In the end, the resolution was defeated by 14 votes to 8. By 12 votes to 6, the Council passed a resolution that contractors to the Corporation employing bricklayers' labourers shall pay them not less than 6½d. per hour.

Bury Gas-Workers Apply for an Advance.

The Gas Committee of the Bury Corporation considered, at last week's meeting, an application which had been received from the local branch of the men's organization for an increase of 3d. per day, and four days' holiday each year with full pay, to stokers, firemen, coal and coke elevator men, engine boiler men, and sulphate plant workers in the employ of the Corporation. It was decided to refer the matter to a Special Sub-Committee. Quite recently the Town Council agreed to the adoption of a minimum wage of 25s. a week for all employees. The lamplighters in the service of the Corporation have also made application for an increase in wages.

SELBY'S SUCCESSFUL GAS UNDERTAKING.

Complimentary Banquet to the Chairman of the District Council.

There was a very interesting gathering at Selby last Friday evening, when, in celebration of the paying-off of the last instalment of the original loan of £20,000 for the purchase of the gas-works—to which reference has already been made in the "JOURNAL"—the Urban District Council entertained at dinner their Chairman (Mr. Mark Scott), who was largely instrumental in bringing about the transfer of the undertaking twenty years ago. The value of the works is now estimated at about £40,000; and their acquisition has been profitable for the town. The Vice-Chairman of the Council (Mr. T. S. Ullathorne) presided, and, in proposing "Our Guest," pointed out that the purchase of the gas-works was entirely due to Mr. Scott. It was said that they would not pay, and that perhaps the rates or the charges for gas would be raised; and Mr. Scott had to meet with considerable opposition. Time had shown that his opponents were wrong. He overcame all opposition; and the result was one of the best assets the Council and town possessed. Mr. Scott had worked hard for twenty years as Chairman of the Gas Committee, and had carefully gone into every detail to make the undertaking a success. There had been additions to the plant, and in the twenty years of his Chairmanship £2095 had been taken from the gas profits for the relief of the rates, which was equal to a rate of 1d. in the pound for the period. This year £400 had been applied in rate relief. Responding to the toast, Mr. Scott said he had at the time of the purchase the strongest possible conviction that it would turn out satisfactorily; and he had never wavered in this conviction. The Local Board supported him twenty years ago, and the ratepayers had not been called upon to contribute a farthing towards the concern. The credit for the success of the gas undertaking was due to the Managers, among whom none stood more highly than their present Manager (Mr. T. H. Alderson). Mr. Scott was then handed a Georgian silver teapot and an illuminated address, in recognition of his public services, which extend over a period of forty years; and he acknowledged the gifts in feeling terms.

PLEA FOR CHEAPER GAS AT SOUTHPORT.

Installation of Glover-West Vertical Retorts Sanctioned.

The question of cheaper gas was raised at the last meeting of the Southport Town Council, when the minutes of the Gas Committee were submitted for confirmation; these including a resolution "that the tender of West's Gas Improvement Company, Limited, for the installation of vertical retorts on the Glover-West system of continuous carbonization, for the sum of £15,705, be accepted." Mr. Snow, who introduced the subject, said he understood that this new system of carbonization was likely to be a great boon to Southport, and he also understood that by it a saving would be effected in the cost of production of the commodity which was in daily use by the majority of ratepayers in the town and district. This being so, he thought the Chairman and members of the Gas Committee might give an undertaking—or hold out some hope—that in the near future there would be a reduction in the price of gas, which was now 2s. 8d. per 1000 cubic feet. In the course of his reply, Mr. Trounson, the Chairman of the Gas Committee, said it had been his opinion for years that there should be a reduction in the price of the gas; and if things had fitted in, it would have taken place before this. There were, however, many other matters surrounding the question; not the least being the amount that was expected from the Gas Department in relief of the rates. It was a matter of policy, and at the moment he did not feel disposed to say anything further on the point; but he hoped the day would come, and before long, when a reduction in the price of gas would be made. It was anticipated the department would realize more than £4000 per annum in increased profits by the adoption of the new retorts; and he reminded the Council that the cost was to be paid out of revenue. In five years, the £15,000, and an additional £3000 or £4000, would be wiped out. The minutes were confirmed.

At a meeting of the Executive Committee of the Southport Company-House Proprietors' Association, held last Thursday week, the following resolution was adopted unanimously, and a copy ordered to be sent to the Chairman of the Gas Committee of the Corporation: "That the Executive of the Company-House Proprietors' Association, in view of the large profits that are made through the Gas Estate year by year, hope that the Gas Committee will see their way clear to reduce the price of gas, both for lighting and cooking, to 2s. 6d. per 1000 cubic feet, which we consider a very moderate and reasonable reduction under the circumstances."

The township of Birkdale ceases to exist as a separate entity next Sunday, upon its incorporation with the borough of Southport; and according to the terms agreed upon, gas consumers in Birkdale are to be supplied henceforth at the same price as consumers in Southport, a reduction of 6d. per 1000 cubic feet—that is, from 3s. 2d. to 2s. 8d. As a matter of fact, the consumers in Birkdale have been getting their gas at the reduced charge since the commencement of the year. In the ordinary course of events, they would not have been entitled to this until April 1; but as the Southport Corporation Gas Department would, at the end of the March quarter, have to give Birkdale a rebate amounting to between £800 and £900, it was arranged during the negotiations for amalgamation that it would be a fair set-off against the non-payment of this rebate for gas consumers in Birkdale to be charged at the reduced rate as from the commencement of the present year. In the last financial year, Birkdale took from the Southport Corporation 70,739,000 cubic feet of gas, representing 17·19 per cent. of the total consumption.

PROFITS OF WEST BROMWICH GAS UNDERTAKING.

Allocation to the Rates.

At a Special Meeting of the West Bromwich Town Council on Friday evening—the Mayor (Mr. J. A. Kenrick) presiding—a recommendation was considered for the allocation of £500 from the profits of the Gas Department and £200 from the Electricity Department in relief of the rates for the ensuing year.

Mr. Halford said he thought the present was an inopportune time to vote away profits from the gas and electrical concerns in relief of the rates. It was a wasteful way of relieving the ratepayers, and it was unjust to the consumers. The gas undertaking during its existence had contributed the very handsome sum of £35,000 to the rates; and it reflected great credit upon those who had had the management of the concern. He objected to the principle of voting away gas and electricity profits to people who were assessed to the rates, while their tenants who burnt gas and electricity got nothing out of it.

Mr. Bell also opposed the principle of allocating the profits made in the gas and electricity undertakings in relief of the rates. He did not believe such an appropriation of profits to the rates was conducive to economy. They were not aware of the facts of the working of the gas undertaking; but he understood the profit made was considerably larger than the sum proposed to be allocated to the rates. He would, however, like to know what relation the profit had to the poor quality of the gas they had been supplied with of late, and the complaints that had been made. He asked whether it was not a fact that some of the manufacturers of the town who took gas for power purposes were being supplied at less than cost price. At any rate, there was this impression abroad. He also considered the prepayment meter charge an unfair one. They were charging these consumers 3s. 4d. per 1000 cubic feet, while the ordinary gas consumers only paid 2s. 8d.—a difference of 8d. per 1000 feet. In Birmingham, the difference between the two classes was only 3d. per 1000 feet; and he seriously claimed that the tradesmen in the town were entitled to a reduction in the price of gas.

Mr. J. Brockhouse (the Chairman of the Gas Committee), in reply, denied that they were selling gas for power purposes at less than cost price. The cost of gas in their holders was just over 1s. per 1000 feet; and they were selling to large consumers at 1s. 5d., which was the lowest rate. He was afraid, the way things were going on, that instead of there being a reduction to gas consumers there would be an increase. They did not yet know what they would have to pay for coal. As to the prepayment meter consumers, they were the worst paying department of the whole gas concern; and the system had not realized what was anticipated when it was introduced. With regard to the allocation of gas profits to the rates, his views came within the range of those expressed by Mr. Halford and Mr. Bell; but they could not alter it now, and as Chairman of the Gas Committee he should be very foolish indeed if he were to support anything of the kind.

Ultimately, the recommendation to help the rates from the profits of the Gas and Electricity Departments was carried; two only voting against it.

CROMER GAS COMPANY.

Electric Light Competition—Committee of Inspection Appointed.

There was some criticism of the Directors of the Cromer Gas Company on the occasion of the annual meeting on Monday last week, at which the Chairman (Mr. J. Lovelace) presided. The gross profit for the past year was £1468, compared with £1496 for 1910, and the net balance on the profit and loss account, after meeting debenture interest, &c., was £1109. The Directors recommended that £1000 of this should be used in further writing-down the suspense account, and that the balance should be carried forward. There was an increase of upwards of a million cubic feet in the sale of gas; and the receipts from residuals were higher under all heads. A sum of £346 more than before was expended, mainly for the repair of mains and services. The carbonizing results returned by the Manager (Mr. W. H. Archer) showed a make of 11,300 cubic feet of gas per ton of coal. Consequent upon the repair of the mains, the unaccounted-for gas had been reduced by nearly 600,000 cubic feet. The Directors considered that, having regard to the difficulties under which the Company laboured, the increased consumption showed that their efforts had not been altogether unsuccessful. They acknowledged the value of the services rendered by their colleague Mr. Percy Griffith, and recommended that £15 15s. be again voted towards his out-of-pocket expenses.

The Chairman, in moving the adoption of the report, said that during the year the Company had worked under very great difficulties. There were two illuminants in the place; but their rival could not compare with gas, either as to cheapness or reliability of light. On two nights recently, the streets had been left in the dark; but it was not owing to the gas The Directors tried to increase the consumption of gas as much as possible.

The motion having been seconded, Mr. E. L. Burton characterized the report as the worst he had ever seen. He said the Company was greatly over-capitalized—three-fifths of the capital having no existence in terms of pounds, shillings, and pence; and the increased consumption was only about a million cubic feet compared with the year 1900. He could not imagine what the town was about ever to allow electric light to come into it. He understood that the charge for electricity was 7d. per unit, and for gas 4s. 4d per 1000 cubic feet. When, as in the present case, the electric light was run in the interests of the town, it crippled the power and growth of the gas company. He could not but believe that if the public-spirited men in the place had realized what the undertaking was going to be, they would have hesitated. The streets were lit by the electric light; and a more disgraceful exhibition of street lighting he had never seen. Had it not been for the town's interest in the electric light, the Gas Company would have been prosperous. He believed there was a good future for Cromer; and the Gas Company should have some share in its increased prosperity. Having criticized various matters connected with the finances of the Company, the speaker said he considered that, in the interests of the shareholders, what was needed was an absolute change in the management. He felt that a Company of this size should be in the hands of a technical man, capable of combining both the managerial and secretarial duties. To have a successful resuscitation, the Company should be in new hands. He believed that fresh methods, new ideas, and more energy were absolutely necessary if the concern was to be brought into a paying condition again.

Mr. H. Mitchell expressed his gratitude to the previous speaker for his remarks. Mr. C. J. Parker criticized the expense incurred in stopping the leakage of gas, and said it worked out to £1 for every 10s. saved. The Chairman, in reply, said they might have to spend £1 to get 5s. Rev. H. C. Fitch said he feared a great deal of the leakage was due to the introduction of the steam-roller into Cromer. He reminded the meeting of the special difficulties with which the Directors were faced when the works were being constructed, and said they had hardly got over them when they were met with the rivalry of the electric light.

The report was adopted. The retiring Directors and Auditor having been re-elected, a Committee of five shareholders was appointed "to confer with the Directors, and discuss with them any measures calculated to improve the Company's position." The Committee consists of Messrs. Burton, F. Smallbone, Mitchell, Parker, and G. A. Rounce.

Sale of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards sold various parcels of gas companies' securities, including a new issue of capital by the Directors of the Westgate and Birchington Gas Company, which was the first offered. It consisted of 272 new ordinary £10 shares, ranking for a maximum dividend of 7 per cent.; that for the past year on similar shares having been at the rate of £4 18s. per cent. They fetched from £11 10s. to £13 each. Additional £10 shares (7 per cent.) in the Yorktown and Blackwater Gas Company, carrying a dividend at the rate of £8 11s. 6d. per cent. per annum, realized £16 10s. to £16 12s. 6d. apiece. By order of an executor, some consolidated ordinary 5 per cent. stock of the Worthing Gas Company, carrying dividend at the rate of £5 5s. per cent. per annum for the current half year, was sold at £105 10s. per £100. A parcel of consolidated ordinary 5 per cent. stock of the Aylesbury Gas Company, the dividend on which has for some years been at this rate, fetched £96 to £97 10s. per £100.

SULPHATE OF AMMONIA IN GERMANY LAST YEAR.

According to the report of the Deutsche Ammoniak Ver-Kaufs Vereinigung, of Bochum, a translation of which was given in a recent number of the "Iron and Coal Trades Review," the market and sale conditions for sulphate of ammonia last year were favourable; and business proceeded very regularly, notwithstanding an increase in the production. The quantity sold for the Association was 291,004 tons, compared with 302,529 tons the preceding year. The actual tonnage disposed of for the constituents of the Association was 283,011 tons, compared with 292,217 tons in 1910; and 74,368 tons of the former quantity were exported, as contrasted with 99,457 tons the previous year. The diminution in the total turnover is attributed to the possession in the first quarter of considerably smaller stocks than in the corresponding period of 1910, to the prejudice caused to the production owing to the inadequate sales of coke, and to the reduced demands of agriculturists who were unable to place orders at the appropriate time, in consequence of the drought.

The consumption of sulphate of ammonia in Germany last year is returned at 370,000 tons, compared with 350,000 tons in 1910; and a further increase of 45,000 tons is expected in the present year. The imports of sulphate reached 24,463 tons last year, against 31,400 tons in 1910; and 18,123 tons of it were procured from Austria-Hungary, 2685 tons from Great Britain, and 2388 tons from Denmark.

The following figures are given of the production of the industrial countries which come into consideration so far as German business is concerned:—

	1911. Tons.		1910. Tons.
Germany	418,000	..	373,000
Great Britain	378,500	..	369,000
United States	115,000	..	116,000
France	60,000	..	56,000
Belgium	40,000	..	43,000
Austria-Hungary, Spain, &c.	169,500	..	100,000

The new constituents which joined the Association during the past year are the Austrian Mannesmann Tube-Works, of Vienna, the Tremonia Corporation, of Dortmund, the Ewald Colliery, of Herten, the Hermann Mining Company, of Bork, and the German Mond Gas and Bye-Products Company, of Berlin.

HARRINGTON GAS-WORKS PURCHASE.

A Local Government Board inquiry was recently held by Mr. H. R. Cooper in relation to an application by the Harrington Urban District Council for a Provisional Order enabling them to purchase the undertaking of the Harrington Gaslight Company, Limited.

It was explained by Mr. W. B. Harbinson, who represented the Council, that the Order was desired to enable the Council to complete an agreement entered into with the Company. The undertaking had been a successful one; and the ratepayers were practically unanimous in supporting the Council in the purchase of the works. The Clerk (Mr. W. White) said the number of houses in the district that could be supplied with gas was 700; and the number at present supplied was 491. Mr. Arthur Silverthorne had been called in to value the property; and, acting on his advice, successful steps had been taken to secure a long lease of the land on which the works were situated. On receipt of Mr. Silverthorne's exhaustive report, the Committee who had the matter in hand made a provisional offer of £7000 for the undertaking, subject to the approval of the Council. Subsequently, a price of £7100 was agreed to. The proposal was to borrow £8500, to allow for increasing the holder capacity and providing new meters, stoves, and working capital; and the Council asked that the loan should be extended over 35 years.

Mr. John Noble, the Borough Treasurer of Workington, said he had been asked to advise the Council on the question; and he entirely agreed that the price to be paid was a fair and reasonable one. The dividends paid by the Company for the last seven years had averaged over 6½ per cent., without any deduction for income-tax. The net profits over this period worked out at £474 per annum. The price was only 15 years' purchase of this maintainable profit. Charges for interest and repayment of £8000, with interest at 3¾ per cent., spread over 35 years, would be £414 per annum.

Mr. E. G. Hutchinson, the Manager of the Workington Gas-Works, also stated that he had been consulted on the matter, and thought the price very reasonable for what was a valuable property. An additional lift to the new holder would give a total storage capacity equal to 1½ days' consumption in mid-winter. Certain improvements might be secured in the manufacturing operations; and the yield of gas could be increased by 1000 cubic feet per ton of coal. There was no reason why the heavy leakage, too, should not be considerably reduced. He estimated that it would cost £230 to put the works in order. The price of gas was 3s. 9d. per 1000 cubic feet.

Fused Electric Wire Causes Commotion in a Church.—On Sunday evening, the 17th inst., some of the congregation at St. Mark's Church, Newport (Mon.), were thrown into a state of commotion by a sound of cracking and a smell as of burning rubber. The cause was the fusing of the electric wiring; and the point of danger soon became revealed by the appearance of smoke curling up dangerously near the roof of the church. One of the Gas Company's inspectors (Mr. R. Jones), noticing the fusion, gave the verger warning of the danger; and he promptly diverted the current to some of the previously unlighted lamps, the sudden illumination of which was the only intimation conveyed to the bulk of the congregation that anything unusual had occurred. The fortunate absence of panic was due to the self-possession of the clergyman, the Rev. R. J. B. Lewis. Though he noticed a little commotion among the congregation, he never, either by voice or gesture, betrayed the fact that something was amiss.

SLOUGH WATER-WORKS PURCHASE ARBITRATION.

Sixth Day's Proceedings.

With the present instalment, the report is completed of the proceedings in the arbitration recently held at the Surveyors' Institution, Great George Street, Westminster, to determine the price to be paid by the Slough Urban District Council for the undertaking of the Slough Water-Works Company. The proceedings arose out of an Act passed last year, to carry into effect an agreement arrived at between the parties. The evidence and the opening speeches were dealt with in the last two numbers of the "JOURNAL" (pp. 745 and 826).

The Arbitrators were Mr. JOHN E. WILLCOX, for the Urban District Council, and Mr. CHARLES HAWKSLEY, for the Water Company. Mr. A. J. RAM, K.C., acted as Umpire.

Mr. BALFOUR BROWNE, K.C., Mr. HONORATUS LLOYD, K.C., Mr. TYLDESLEY JONES, and Mr. W. B. CLODE (instructed by Messrs. Pontifex, Pitt, and Johnson) appeared for the Company; while Mr. WEDDERBURN, K.C., and Mr. F. N. KEEN (instructed by Messrs. Baker and Co.) represented the Council.

The Council's Case Summed Up.

The UMPIRE, at the opening of the proceedings, said it had been left in the hands of the tribunal to decide who should bear the cost of the adjournment on the day when the hearing should have been commenced. The adjournment was asked for in the interests of the Company. The decision therefore was that the Company should pay the cost of hiring the room for the day or days lost. Also that they should pay all costs of correspondence occasioned by the postponement, and further any costs such as payments of witnesses (if any) for lost time. There remained only the question of the charges of the tribunal for sitting that day; and these fees were to be divided.

Mr. WEDDERBURN, in his address on behalf of the Council, said it was a truism to state that the ultimate aim of the proceedings was an award which should be just to the shareholders on the one side and to the ratepayers on the other. This was a matter upon which they were all agreed. He would have imagined there could be no question that what they had to do was to give the shareholders such a sum as would eventually provide them with an equal income equally well secured; and he could not help thinking that Mr. Eaton, and to a still greater extent Mr. Taylor, had never really realized what the duty of the tribunal was. These witnesses seemed (especially Mr. Taylor) to go on the assumption that what had to be done ultimately was to value the whole undertaking. This, however, was not the case. What the tribunal had to give their award for was not the whole value of the undertaking, but the interest of the shareholders in the undertaking—which might be a very different thing. The question was, as had often been said, not what the purchaser would take, but what the vendor would lose; and it was for what the vendor would lose that he had to be compensated. The whole interest of the shareholders in the undertaking was the right to take a maximum dividend out of it. After they had taken this dividend, and any back-dividends accrued, and put to the reserve fund what they could, the rest of the profit did not belong to them, but to the water consumers. When Mr. Eaton talked of latent value in the undertaking which only became effective when the transfer took place, he (Counsel) did not know what he meant. If the assumption was that, at the moment of transfer, things in connection with the undertaking assumed a value which nobody ever put upon them before, and if this were true, it would not affect what the tribunal had to value. The really important element of the case was the question of giving the shareholders an equal income equally well secured; and in this connection there were three things that had to be looked at: There were the character of the investment, the value of money at the time the transfer was going to take place, and the nature of other investments into which the money must be put. The attitude which Mr. Silcox had adopted on this point was perfectly clear; and it was all summed up in the word "reinstatement." The shareholders should have such a sum awarded to them that they could reinstate themselves without loss. The value of money Mr. Eaton admitted was material, because his reduction from the 40 years' purchase claimed for Devonport, to 30 years in this case, was based on the fact that the value of money had in recent years fallen about 25 per cent.; and if the Money Market was an element, surely there could be nothing more material than the condition of the water companies' section of it. There was now no difficulty whatever in getting 4 to 4½ per cent. from good water investments; and this was most important to take into account in arriving at the number of years' purchase. In the list of companies put in by the Council's witnesses, the yield ranged from £4 17s. to £4 per cent.; the average being £4 6s. 5d., or just over 4¼ per cent. This being so, the figure of 25 years' purchase (which was 4 per cent), on the assumption that this was a high-class undertaking, was not ungenerous. The case of Worksop had been introduced. They did not know the number of years awarded there; but they could make a very fair guess. The two instances were closely alike; but Worksop was better than Slough—Mr. Eaton had admitted this. Worksop was a maximum-dividend Company, with over £1000 of surplus revenue. It was originally a small undertaking, which grew up. For Worksop, Mr. Eaton claimed 33½ years' purchase; whereas here he was asking for 30 years. If Mr. Eaton was to be relied upon, it would be impossible not to give Slough a less number of years than had been awarded to Worksop. He (Counsel) suggested that, apart from over-spent capital, back-dividends, debentures, and cost of re-investment, the number of years' purchase which the Worksop award showed did not greatly exceed 25. Mr. Eaton said a less number of years ought to be given here. Then there were the four elements of insecurity to be considered—quality, from the point of view of purity, and in a sense hardness; pressure; quantity, with the risk of another authority drawing on the source of supply; and the high charges. To talk of the Slough Water Company as being anything like perfect, was too absurd. A small Company started to supply a small district, one would not expect to find it perfect. It had been

run for many years in order to provide a small lot of people closely connected with as large an income as they could get out of it. One would expect old works and many inadequacies. It had been said that the criticisms now put forward were for the purposes of the arbitration. But this was not so. It was clear from previous parliamentary proceedings, that the matters of high charges and want of pressure had been brought out before; but the Council's knowledge now was quite different from what it was then. Dr. Rideal's analyses were conclusive that the water did on occasion contain the *bacillus coli*; and therefore it needed watching. If it was there, where did it come from? Unless some other source could be found, it came either from the surface or the river. The samples were taken in the usual manner, and it was said the *bacillus* could not come from the surface. Therefore the presence of the *bacillus coli* showed conclusively that the borehole water was partly river water. If the Council had made out their case as to the risk of river water in the boreholes, this was a matter which must be taken into account in the award—though it was impossible to say, in money, to what extent. It must mean revenue expenditure to watch the water. It might mean nothing more for years; but, on the other hand, it might mean the cost of purification or abandoning the existing works altogether. Even without abandoning the present boreholes, it might be necessary to reduce the present pumping, in order to prevent a greater draught on the river and therefore larger pressure of *bacilli*. These difficulties might be enhanced if the level of the water was lowered, owing to pumping by other people. As to softening, they had heard there was a "craze" for this; and at Slough the demand might become so persistent as to compel the Council to do something in this way. If it were found that the water needed filtration, the two operations might be combined. The question of pressure had been dealt with largely from the fire point of view; and the facts were clear. The fire-engine was not a large one; and what it really amounted to was that Slough at the present moment was totally unable to deal with any fire, except by manipulation of the mains, and even then the condition of things was unsatisfactory. It was argued that there was no legal obligation to provide a fire supply at any particular pressure; but the answer to this was that, whatever the statutory obligation was, in a high-class undertaking one did not have to resort to manipulating the mains so as to secure a supply of water sufficient for an ordinary fire-engine. The inadequate pressure was due to the large proportion of small mains—old mains put down years ago, when Slough was a very little place. In the newer area, the mains were larger. Nobody could suppose that, if this undertaking were being laid out to-day as a first-class concern, mains would be put down like those now in the ground. The second cause of defective pressure was the position of the reservoir. Another element of risk was that of an authority or person coming to the same neighbourhood for a supply of water. The Company abandoned their old works because the Great Western Railway came and drew on the well; and the chance of a similar thing happening again must be taken into account. The final element was the high charges; but this matter he would not make very much of. Mr. Diggle's attitude in regard to deductions was a perfectly logical and clear one. He said that in his view there were certain works which must be carried out immediately; and the cost of these justified him in reducing the 25 years' purchase by 2½ years, to 22½ years. This was for dealing with the question of pressure. Then he said, as regarded the other three risks, he could not assess them in money; and therefore he did not knock off any years for them, but set them against the surplus revenue which the Company undoubtedly had. Mr. Silcox, on the other hand, said he was not concerned with these things. He looked purely to re-instatement. With regard to the £5000 debenture stock, he urged that while the Company was in existence it was perpetual; but the moment the Company was wound-up, there was introduced into the debentures a duty of repayment. If this were so, £5000 was all that was due. Even if it was absolutely irredeemable, the 4 per cent. basis would be ample, which would make the price £125 per £100 of stock.

The UMPIRE: Do you admit that, while the Company are in existence, if they expressed a wish to pay off these debentures, the holders could say "No"?

Mr. WEDDERBURN replied that he did. Continuing, he maintained that the debenture stock was not part of the undertaking on which the additional 10 per cent. should be given. The shareholders were to have 10 per cent. in addition to their interest in the undertaking; and they would also have enough money to enable them to pay off the debenture holders. The 10 per cent. was given as between the shareholders and the Council, in the absence of the debenture holders who were not parties to it at all.

Mr. BALFOUR BROWNE remarked that this was a question of law; and if the tribunal found that he was not entitled to the 10 per cent. on the debentures, he would ask for a special case.

Mr. WEDDERBURN intimated that he would be satisfied to abide by the decision of the tribunal.

The UMPIRE: What we have to award as part of the amount to be paid to the Company is such a sum of money as the tribunal think is "payable in satisfaction of the perpetual debenture stock."

Mr. WEDDERBURN then proceeded to deal with the purchase of land; and afterwards he commented upon the question of back-dividends. He maintained that the Committee intended all back-dividends before Jan. 1, 1880, should be wiped out; and to pay the £750 in the manner the Company had done after this decision, was to go behind the Committee. Therefore the Council deducted £750 from the starting figure—making it £7208.

Mr. BALFOUR BROWNE said that whether the Company were entitled to this £750 in addition to the back-dividends since 1880, was a question of law again; and he would ask for a case if the tribunal decided against him.

Mr. WEDDERBURN: I am perfectly content to leave the matter in your hands.

The UMPIRE: I must say that I do not think it is entirely a matter of law.

Mr. WEDDERBURN added that the Council discounted the £7208 on the basis of the Company paying off £1200 a year, which was more than they had paid in the past. The only remaining point was the income-tax, which had been dealt with in the evidence.

The UMPIRE asked in what form the parties would wish the award made; and it was agreed that it should be in one figure.

Reply for the Company.

Mr. BALFOUR BROWNE, in the course of his reply on behalf of the Company, said the award he asked for was the exact amount of Mr. Brough Taylor's valuation. The other side had overlooked entirely what the tribunal were doing here. They had nothing to do with this nonsense about justice. It was not for them to do justice, but to do what the Act of Parliament asked them to. Parliament had told them to value the undertaking; and the undertaking which they were to value was defined in clause 3 of the Act of 1911. The things mentioned in this clause represented the capital that had been spent, and not only the capital of the shareholders, but that which the shareholders borrowed—namely, the £5000 of debenture stock. How were they to arrive at the value? The Company started with the total money earned; but Mr. Diggle, on the other hand, began with merely the amount divided as maximum dividend. One of the main matters was, How was the maintainable income (because he preferred this to maximum dividend) to be capitalized? The Council said 22½ years' purchase, and the Company 30 years. This was a question for the tribunal, after considering the evidence. Mr. Diggle said he would have put it at 25 years, had it not been for various defects. But not one of them could be considered by the tribunal. He did not agree with Mr. Diggle in regard to a first-class undertaking being put at 25 years' purchase, but believed that an undertaking such as this was worth 30 years. Of course, there were defects in some cases to be taken into consideration; but they were not the things mentioned here. The defects which should be taken into consideration as against the capitalized value were those which shook the stability of the income; and not one of those before the tribunal did this. The presence of the *bacillus coli* had been mentioned; but this did not touch his £3018 of divisible income. Dr. Rideal had said over and over again that it was a first-rate water. What was the use of saying that the water must be watched? It did not in the least affect the stability of the income. Dr. Thresh said he did not believe it was Thames water; and there was no probability of it being so, for the reason that had been given—that an immense amount of water flowed from the chalk to the Thames, and it was impossible for it to run in two directions at the same time. But if it were, he was perfectly satisfied that there was plenty of water in the Thames; and it had undergone natural filtration. It was argued that the *bacillus coli* found must have come from the river or the surface. It might come from dust blown into the well, and be cured by putting a cover on. But it was not necessary. His income was also secure as regarded quantity, because they had not only credited him with water from the chalk, but from the Thames besides. As to pressure, the whole of the objection was with reference to fire supplies. It was admitted that the water furnished by the Company found its way to the top storey of the houses. He did not understand this part of the case. With the available pressure, the Company had earned their income. Why should they not go on earning it? It was extraordinary that no one had been called from the Slough Fire Brigade; but, as a matter of fact, there was nothing in it from beginning to end. There was a long argument as to what the Company's duty was; but their statutory duty had nothing to do with fire at all. Mr. Diggle showed that the enlargement of certain distributing mains would cost £170; but they had to value the undertaking as it was. Could the Company, with the present distributing mains, earn £3018? There was no suggestion that they could not. There was not an undertaking in the country which had no 3-inch mains. Then as to the risk that the water might be taken by some other authority. This would be serious if proved, because if they could show any real probability of the water being taken, the Company could not maintain their income. But it had not been proved. They knew now that where a well was already in existence Parliament would not allow other people to go and put down wells and pump away the water. As to the charges, the tribunal had no right to consider that Parliament might have reduced the rates, because if they were to do this they might also consider that Parliament might have increased them. They could not tell what Parliament would do. The rates had been reduced and reduced again. A table had been put in showing, since 1906, all the charges allowed by Parliament; and from this it appeared that the Slough Company's rates, as fixed in that year, were lower than the average. It had also been argued that the reservoir needed to be reconstructed. Was this the right way to value the concern? He did not know a single undertaking in the country in connection with which one could not get an engineer to come and say, "Were I laying it out for the first time, I should do it differently." Every water engineer had his own ideas. The existing reservoir was not in too low a position. With reference to the debenture stock, if they had an income of £250 a year, and the other side could not perceive any possible risk to it, what was it worth? His learned friend had said that while the Company were in existence it was a perpetual charge, and that if the Company had continued a holder could have refused to be paid off. He suggested that it was worth £150 for every £100 of stock. The criticism was that on a winding-up the stockholders might not get more than their £100. But this was not a winding-up; it was a purchase. Under the Act a sum of 10 per cent. was to be allowed as compensation for compulsory purchase; and could anybody say that, though the debentures were to be taken as part of the price or consideration, the 10 per cent. was not to be paid on the whole price? The Act said it was. Therefore he claimed the 10 per cent. on the debenture stock, without much doubt that he would get it. Practically they were agreed as to the over-spent capital, except with regard to two items. It was said that the Company claimed too much for the land, and that one part of it should not have been bought at all. But the Council allowed something, because they were going to get the land. Here, again, this might have been of value if the other side could have alleged fraud; but they did not do this. The money was paid; and this was what the tribunal had to deal with. As to the back-dividends, he would refer first to the £750. This was simply and solely a point of law. There was no question that before the Act of 1910 the Company had the right to pay a large amount of back-dividends; but in that year Parliament passed a limiting section, knowing the period named would date from the Royal Assent. The

Company were not to pay any back-dividends in respect of any period previous to Jan. 1, 1880. They need not have accepted such a clause; but they did. Then the other side urged that the Company would have applied only £1200 a year to the payment of back-dividends; but the Company said they would have applied a sum which would have paid off the amount in two years, instead of six. The Company might not have had a right to pay income-tax; but if they were entitled to disburse the amount under the name of back-dividends, what did it matter? The extraordinary thing was that now it was desired to take the sum away from people who were not responsible at all. With regard to the argument that the market value of other securities was a guide for the tribunal, if they looked at the Stock Exchange lists, they got merely a Stock Exchange opinion of the value. If it was merely necessary to secure such a list and take the average value of water undertakings in the country, arbitrations of this kind would soon cease. If the tribunal came to the conclusion that this was a thoroughly good water undertaking, well secured by (1) the works, which were not criticized except as to pressure, (2) the quantity of water, and (3) the growth of the district, he would ask them to find that 30 years was a fair multiplier to take. He also asked them to say that not one of the criticisms made affected the stability of the income. They were mere quibble. They were ingenious; but they had no real bearing on the amount that could be earned. They had earned £3018 with these disabilities which were not serious ones. He asked the tribunal to allow the amount claimed for the purchase of land. It was money they had paid; it being admitted that it was *bonâ-fide*. As to the back-dividends, he asked that these should be discounted in the manner shown by Mr. Cash, and not in the unfair way the other side had done. There never was a better little pumping scheme than this, never a more secure income at the back of share and debenture holders; and therefore he claimed the highest possible multiplier. If the tribunal decided against the Company on the question of the £750 back-dividend, or the 10 per cent. on the debenture stock, he would ask that the award should be put in the form of a special case, in order that it might be tested. If there was any doubt as to these being perpetual debentures, this also might be put as a special case.

METROPOLITAN WATER BOARD'S FINANCIAL POSITION.

Report by the Finance Committee of the Board.—Borough Councils and Prospective Rates-in-Aid.

It may be remembered that rather more than two years ago, the Metropolitan Water Board referred it to the Finance Committee to inquire and report on the financial position, to compare the undertaking to-day with the condition under the Water Companies, and to give such information as might enable the Board to judge whether an equilibrium as between receipts and expenditure was or was not likely to be attained in the near future. The Committee have made their report, and it was on the *agenda* for the meeting last Friday. They deal with the first consideration under two heads: (1) Capital, and (2) income and expenditure on revenue account; and, after an analysis of the position from these standpoints they say: "Without committing ourselves to any specific period or time, we think it is clear that there is no possibility of equilibrium between receipts and expenditure being attained in the near future, but that deficiencies will occur for many years to come. The deficiencies down to March 31, 1912, average £50,000 per annum." This deficiency amounted on March 31, 1911, to £135,835. To that must be added the deficiency for 1911-12, which was estimated to be £85,750, but which the Committee think will be less. Altogether, they put the deficiencies at the 31st inst. at the round sum of £200,000. Dealing then with the question of a deficiency rate, they point out that under the Act the precept could not be levied upon the whole of the Board's area, but only upon areas in borough and urban districts (including the City) which have the right for the time being to be represented on the Board. They are strongly of opinion that efforts should be made to avoid levying a rate, and that Parliament should be asked to review the situation, with a view to new provisions being enacted upon a more simple and equitable basis. The Board were asked to declare that legislation is expedient; and that the Local Government Board should be interviewed on the subject, so as to arrange for the promotion of an amending Act. This they did at the meeting on Friday, when the report was formally received.

The question of the power of Metropolitan Borough Councils to insert in their rate demand notes amounts in respect of contributions to the Metropolitan Water Board, to meet a deficiency in their water fund, before a precept has been made by the Board, was under discussion at the meeting of the London County Council last Tuesday. The Local Government Committee reported that the Hampstead Borough Council's demand notes for the half year to the 31st inst. contained an amount of 0·52d. in the pound to meet such contribution; the sum estimated to be raised being £2200. As the Board had not levied a deficiency rate, under the provisions of section 15 of the Metropolis Water Act, 1902, the Committee were advised that the Borough Council had no power to include the above-named amount in the general rate. They were further advised that if the Borough Council collected any money in respect of the expenses of the Board, and no precept was issued, the amount need not be ear-marked for the purpose for which it had been levied, but could be applied in reduction of the next general district rate. The Committee stated that demand notes had been received in respect of several of the County Council's properties in Hampstead; and they had been in communication with the Borough Council on the subject. After consideration, however, they decided to authorize the payment of the rates; but they intimated that the County Council would object to any item being included in future rates in anticipation of a deficiency rate by the Water Board.

When the report of the Committee was reached, Mr. W. C. Johnson submitted that the demand made by the Borough Council was illegal. The Board had not levied a deficiency rate, and therefore the Council had no right to claim any money from the ratepayers. The Board would, in all probability, never touch it, and it would be kept by the Borough Council, and used in reduction of the district rate. If the County Council allowed this to go on, every borough in London could send out a demand note with totally fictitious items, either for the Water Board or the County Council, draw the money from the ratepayers, and use it to reduce a general rate. He believed the Finance Committee of the Council were aware of the danger, and refused to pay the demand made by Hampstead; but apparently the members of the Local Government Committee were not so strenuous in their defence of the ratepayers. He was told that, owing to effluxion of time, the rate could not now be appealed against. If this was so, the blame rested with the Local Government Committee. He moved that their report be received, with the exception of the paragraph dealing with the matter to which he had referred. Mr. C. J. Matthew, in seconding the motion, congratulated the Finance Committee on refusing to pay the amount in question; and he supported the protest against these illegal claims being made. Mr. A. T. Taylor, who represents Hampstead on the Council, said it was common knowledge that the Water Board had a very large debt, and that a rate-in-aid would be necessary. So the Hampstead Council had, with commendable foresight, made a demand. He understood that several other Borough Councils had done likewise, only they were not honest enough to put a separate line on their demand notes. If there was no call by the Board this year, the money would be kept till there was one, as he was quite sure there would be. On a division, the motion was defeated by 62 votes to 45; and the report was received.

SUGGESTED REMEDY FOR STRIKES.

In moving the adoption of the report of the Directors of Messrs. Fletcher, Russell, and Co., Limited, at the annual meeting held at Warrington last Wednesday, the Chairman (Mr. George Perkins) referred to the subject which is now uppermost in the minds of the people of this country—the coal miners' strike—and expressed his pleasure in informing the shareholders that it had not affected the Company to the same extent as it seemed to have affected others, though it had hampered them in securing delivery of their goods by the railway companies. He thought it was a pity that disputes between employers and employed were left to be settled by strikes. Surely a less barbarous way could be found, and strikes declared illegal. For example, why should not all disputes of this kind come before (say) five of His Majesty's Judges, assisted by experts, on a simple statement made by each party for their decision, which should be final and conclusive. Probably if the matter were taken out of the hands of the politicians, and given to business men, a way out of the difficulty would be found. The prevalent great unrest in the ranks of labour was destructive to business and injurious to all classes. Of course, capital, which provided wages for labour, had a right to a return for its use; and employers could not be expected to carry on business exclusively for the benefit of employees.

With reference to the Company's affairs, the Chairman said that the Directors trusted the shareholders would consider the results of the past year's working, as shown by the report and accounts submitted to them, satisfactory, having regard to the circumstances of the time and to competition, which was as keen as ever. Though the Directors had had to pay higher prices for nearly all raw materials, they had nevertheless increased their turnover; and this, coupled with the economies they had effected, enabled them to put before the shareholders a better balance-sheet than those for the past few years had been. Having referred in detail to the items of the profit and loss account, the Chairman said that, with the amount brought forward, there was a total of £8362. Deducting the interim dividend at the rate of 6 per cent. per annum paid on the preference shares for the six months ended June 30 last (£1500), there was left a balance of £6862, out of which the Directors recommended the payment of a final dividend on the preference shares, and a dividend of 5 per cent. for the year on the ordinary shares. Should these payments be sanctioned, there would be a balance of £362 to be carried forward. Passing on to deal with the balance-sheet, the Chairman remarked that a rather large amount had been spent on new patterns; but this had been more than wiped out by the amount of depreciation taken off this particular item. The Directors had deemed it expedient to write off the balance of goodwill by reducing the reserve fund by the necessary amount. With regard to the future, if it were not for the National Insurance Act and the desire for increased wages by the workmen, the Directors might have looked forward to better results for the next balance-sheet, as greater benefit would be derived from the economies effected, and a slightly increased price was expected from the consumers. But they hoped for the best, especially if the turnover could be maintained, and there was no further increase in the price of raw materials. The dividends recommended were declared; and the retiring Directors and Auditors were re-elected.

CAPITAL AND LABOUR.

Some Further Facts.

In the course of his remarks when seconding the adoption of the report and accounts at the annual meeting of the Davis Gas-Stove Company on Monday of last week, Mr. H. Newsom Davis made some remarks on the labour unrest which is now so prevalent in the country. Every right-thinking man must, he said, know that the interests of employers and employees were identical, and that the success of one was dependent upon the success of the other. Unfortunately, they had now with them that advanced type of Socialist known as the Syndicalist, whose aim was the overthrow of the present order of society and the seizure of its entire economic system, and who, to gain these ends, spread discontent among the working men and instilled in their minds a spirit of antagonism against their employers. The Syndicalist movement, though of recent growth, was already doing serious harm; and he, for one, would like to see some organization started on behalf of the employers of the country which could get into close touch with the working man, in order to combat the evil theories of the other side, and preach the doctrine of co-operation between

Capital and Labour as the best means of securing industrial prosperity. As employers, the Directors had always been interested in the welfare of the men, and desirous that all of them should be contented in their employment—knowing that the contented man made the best worker. There was one factor of discontent which to-day was difficult to meet. The working man was often told by the trade union organizers that he was not receiving wages commensurate with the profits which his labour was instrumental in earning for his employers. They argued from the standpoint of the price that was paid for making a certain article and the price at which the article was sold. For instance, a moulder was paid 2d. for making a certain casting which was sold at 1s.; and the workmen (without taking into consideration the materials, handling, general administration charges, and selling expenses in connection with this casting) imagined that they were not receiving their fair share for the labour expended upon it. But what were the true facts—at least, so far as this Company were concerned? He found that last year they paid out in dividends £7650; whereas they spent in wages and salaries (exclusive of management expenses) £52,700. In other words, for every 1s. which they spent in wages, they only paid over to the shareholders 1¾d. Then what had they, as shareholders, done for the working man? Instead of drawing out their profits in cash, they had allowed the greater portion to remain in the business for its development and expansion; and this expansion had been so great that at Luton they actually now paid double the wages they did four years ago. Surely this was proof (if proof were wanting) of the mutual interests of Capital and Labour. If the profits had not been made, and the shareholders had not allowed their absorption to such a large extent in the business, the number of men employed by the Company would be practically 50 per cent. less than now.

Mr. H. J. Davis (the Chairman) presided at the meeting, and proposed the adoption of the report, which was agreed to. This stated that the net profits for the year to Dec. 31 amounted to £14,575, to which had to be added the amount brought forward (£4674), giving a total divisible profit of £19,249. Deducting from this the dividend on the 5½ per cent. preference shares for the year and the interim dividend on the ordinary shares at the rate of 5 per cent. per annum for the half year to June, there remained a balance of £14,541. It was proposed to distribute £2942 in paying a dividend on the ordinary shares at the rate of 10 per cent. per annum (less income-tax) for the half year to Dec. 31, making 7½ per cent. for the year; to add £6000 to the reserve account, making it £36,000; and after providing £640 for the proportion of the profits payable to the Directors, there would remain £4957 to carry forward. In the course of the proceedings, it was pointed out that the volume of business done in the past year was a record one in all departments; and various extensions have been carried out at the works. When the additions to the moulding shop have been completed, there will be 3 acres of moulding floor space under one roof. A comparatively large sum was spent in scientific and research work. Mr. Cyril G. Davis drew attention to the excellent aims of the British Commercial Gas Association.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The combined visit by the Eastern and Western sections of the Scottish Junior Gas Associations to the Alloa Gas and Electricity Works, which was to have taken place next Saturday, has been indefinitely postponed, on account of the restricted train services, by reason of the miners' strike.

In connection with the Edinburgh and Leith Corporations' Gas Commissioners' scheme for popularizing gas appliances for domestic purposes, the second demonstration and exhibition were opened in the Roseburn Halls, Murrayfield, on Wednesday. There was a large attendance of ladies; and Bailie Chesser, who opened the exhibition, spoke in terms of warm eulogy of the serviceability and cleanliness of the various appliances that were being shown. Cooking demonstrations were given by Miss Dods throughout the three days of the exhibition; and the most satisfactory results were obtained.

Gas managers throughout Scotland have not their troubles to seek on account of the continuance of the strike among the miners. From several districts there have come reports as to purchases of coal for the purpose of keeping the gas and lighting supplies available for the public; but in the majority of cases, the prices paid have not been divulged. The Glasgow Corporation were heavy purchasers of coal during the week; and the result is that the Gas Department are prepared to maintain a normal supply for at least two months to come. There will be no further changes meantime in regard to the present extent of consumption for street lighting.

A somewhat pessimistic feeling prevails at Aberdeen; and at the meeting of the Town Council on Monday, Lord Provost Maitland made a statement on the subject generally. They had, he reminded the Town Council, curtailed the street lighting, and on a reasonable computation they could hold out for about five or six weeks yet. The endeavour was so to adjust matters that there would be as little inconvenience as possible.

From Arbroath, the report is to the effect that there are at least supplies at the gas-works for about six weeks, and as a consequence the price of coke has been increased. Stonehaven is in the happy situation of being able to hold out until "the middle of May." The Airdrie Town Council have been in the market during the week; and as a result of their purchases, at prices which have not been disclosed, the gas-works supply is assured for "another month at least." Bailie Jardine, at the Lockerbie Town Council on Tuesday, mentioned that there was coal at the gas-works sufficient to last for four weeks. Provost Byers hinted that, with a continuance of the coal strike, the lighting arrangements would be further restricted. The Town Council are selling coke to the poorer classes in the community at 6d. per cwt. The Magistrates of Kirkcaldy, who have had to restrict the street lighting services, at a meeting on Thursday, agreed to ask shopkeepers to close their premises

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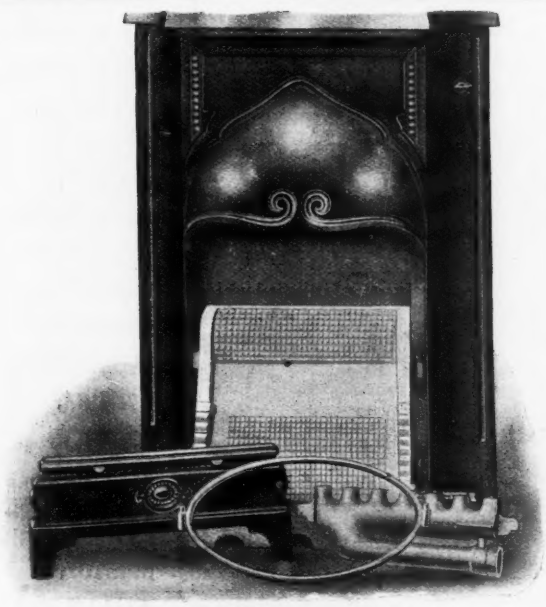

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earlier in the evening. They also requested them to be economical in the use of gas, and not to employ it for advertising purposes. At the gas-works the supply was stated to be sufficient for normal requirements for about a month. The Hamilton Town Council have secured 500 tons of coal; and the gas supply is now assured for about six or seven weeks. At Stranraer, a more extensive use of cookers has increased the gas consumption by over 20,000 cubic feet per week. At the gas-works there is coal sufficient for about three weeks.

At the meeting of the Forfar Town Council on Tuesday, authority was given to the Gas Manager and the Convener of the Gas Committee to act as they thought best in the circumstances. It was pointed out by ex-Bailie Lamb, the Convener, that the coal at the gas-works was sufficient only for about three weeks. If the strike continued, they must certainly reduce the supply of gas. This could be done by reducing the lighting of the streets, and they might also have to recommend shopkeepers to close their premises a little earlier.

With the view of economizing coal, street lighting in Paisley has been somewhat curtailed. The gas-lamps are being lit an hour later than usual, and are extinguished early in the morning, while only each alternate lamp is lighted.

It was mentioned at the meeting of the Greenock Town Council on Tuesday that there were about three weeks' coal supply in hand. Bailie Taylor remarked that he was glad to be able to say that they were obtaining from the sale of residual products as much as would help to make up for the increased cost of coal. At Kirkintilloch, the Gas Department are retailing gas coke at 9d. per cwt. There is a month's supply of coal at the gas-works. From Elgin, it is reported that there is at least three weeks' stock of coal at the gas-works; and the local coal merchants have agreed to give a further supply in the event of a shortage.

A proposal has been put to the Kirkcaldy Town Council that application should be made for a Provisional Order to obtain powers for the laying of gas-pipes outside the burgh. The question had been raised in consequence of the Earl of Rosslyn's Trustees having objected to a pipe-track being cut on the public road between Gallatown and Thornton, the *solum* of which belonged to them. The proposal anent the Provisional Order will be raised in November. Meantime, in about a couple of months the gas will be in Thornton.

At the monthly meeting of the Sanquhar Town Council, complaint was made as to the quality of the gas; Bailie Turnbull remarking that a penny candle sometimes gave a better light. The Convener of the Gas Committee repudiated any aspersions on the quality, saying the gas was splendid; but in deference to the wish of some of the members of the Council, he undertook to see the Gas Manager on the subject.

A meeting of the Girvan Gas Company, Limited, was held on Monday—Mr. Wm. Shankland, the Chairman, presiding. It was resolved to erect an additional gasholder, with a capacity of something like 50,000 cubic feet. It was reported that, owing to the coal strike and consequent dearth of coal, the streets of the borough were likely to be left in darkness unless the Company made considerable sacrifice, as they had only about a fortnight's supply in stock. After considerable discussion, the Company agreed to purchase an extra fortnight's supply of coal at an advance of 130 per cent., and continue the supply of gas to the Town Council for public lighting.

The recent deaths by gas poisoning on the south side of Glasgow formed the subject of investigation on Wednesday by Sheriff Scott Moncrieff and a Jury under the Fatal Accidents Inquiry (Scotland) Acts, held in the County Buildings, Glasgow. In all, three deaths ensued; and in one case the Jury found that the death was due to carbon monoxide poisoning—"the gas having obviously got into the house through the floor." In the other cases, death was found to be due to the same cause—"and in all probability the result of an escape of coal gas permeating the house from outside."

The Edinburgh and District Water Trust have before them a report by their Engineer in which he submits a scheme for the construction of additional filter-beds at Fairmilehead, to have a total area of 5500 square yards. It is pointed out that the present filters at Glencorse are inefficient, and that, as the consumption of water is increasing steadily, something should be done at as early a date as possible. There is a difference of opinion whether sand or mechanical filters should be employed; and the Engineer has been asked to submit a statement showing the respective costs of both methods.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 23.

Sulphate of Ammonia.

Throughout the week, there has been a good inquiry from both home and foreign buyers, and there has been keen competition for all parcels offered for near delivery. The fact of the carbonizing works being compelled to cease has made it necessary for some dealers to replace from other available sources, and consumers of sulphate have also begun to realize the seriousness of the situation in the mining industry. Present quotations are £14 13s. 9d. per ton f.o.b. Hull, £14 15s. per ton f.o.b. Liverpool, and £14 17s. 6d. per ton f.o.b. Leith. In sympathy with the improvement in values in the early position, the tone of the market for forward delivery has also hardened, and it is reported that business has been done for July-December shipment at £14 5s. per ton f.o.b. Liverpool, and at £14 7s. 6d. per ton f.o.b. Leith.

Nitrate of Soda.

The situation of this article continues very firm, but no further advance has to be recorded, and to-day's prices are still 11s. and 11s. 1½d. per cwt. for ordinary and refined qualities respectively, on spot.

LONDON, *March* 25.

Tar Products.

The markets for tar products remain very firm. Pitch is in good demand, and further contracts have been placed during the past week

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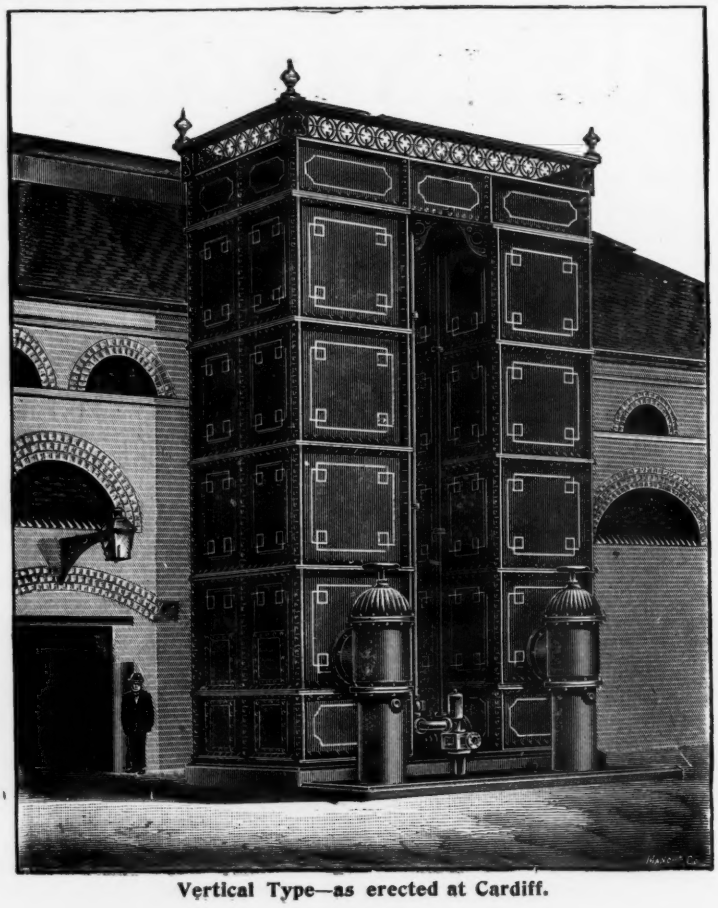

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and other Works.

at the equivalent of to-day's quotations. Benzols remain steady, though there is very little business doing. Heavy naphtha and solvents are in good request; and some fair prices are being obtained for prompt and forward delivery. Creosote maintains its price, though business is rather quiet at the present moment. Crude carbolic acid does not change; and buyers appear to be looking for lower prices.

The average values during the week were: Tar, 25s. 6d. to 29s. 6d. *ex* works. Pitch, London, 48s. to 49s.; east coast, 47s. 6d. to 48s. 6d.; west coast, Clyde 47s. to 47s. 6d., Manchester 46s. to 47s., Liverpool 47s. to 48s. Benzol, 90 per cent., naked, London, 10½d. to 11d.; North, 10d. to 10½d.; 50-90 per cent., naked, London, 10d.; North, 9½d. Toluol, naked, London, 10d. to 10½d.; North, 9½d. to 10d. Crude naphtha, in bulk, London, 4½d. to 5d.; North, 3¾d. to 4½d. Solvent naphtha, naked, London, 1s. to 1s. 0½d. f.o.b.; North, 10¾d. to 11d. f.o.b. Heavy naphtha, naked, London, 11d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 2⅝d. to 3⅛d.; North, 2½d. to 2⅝d., salty; 2⅝d. to 2¾d., liquid. Heavy oils, in bulk, 3¼d. to 3⅜d. Carbolic acid, casks included, 60 per cent., east and west coast, 2s. 8d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

There has been a little more inquiry during the past week, and prices have been very firm. A slight improvement is reported in several quarters. Actual Beckton is quoted at £14; outside London makes, £13 15s. to £13 17s. 6d.; Hull, £14 10s.; Liverpool, £14 11s. 3d. to £14 12s. 6d.; Leith, £14 12s. 6d.; Middlesbrough, £14 10s.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade in the North has shown a little more life in the past few days; and there have not only been small transactions for prompt delivery, but rather larger forward business has been carried through. Two gas undertakings have been able to secure cargoes of coal—one of which was delivered on the Tyne without any difficulty, while the other, for Middlesbrough, was delayed some days by the opposition of the local dockers. Ultimately volunteers from the men of the Corporation unloaded the steamer. It is believed that relatively high prices were paid for this coal; but the actual figures have not transpired. There is now, with the more hopeful prospect as to resumption of work, some disposition to quote prices for coal for delivery at the end of the strike; and for best steams about 15s. per ton f.o.b. is quoted. No actual figures are named for gas coal as yet; but much of this kind is claimed for contracts which will begin again when the pits are restarted. Coke is still being produced in small quantities, and is high in price. Gas coke is in fair output, but more is used at the works. The demand is strong for that for sale—the retail quantities being rapidly taken up.

Scotch Coal Trade.

Abnormal prices still rule in the coal trade throughout Scotland; and all the transactions are at special quotations out of all proportion to the normal price of coal. On Friday, bunker coal was delivered Glasgow, f.o.b., at from 27s. 6d. to 30s. per ton; and dross at the pithead went as high as 18s. 6d. per ton.

Mr. Eaton and the Patent Block Tar, &c., Company.

The following remarks appeared in a recent number of "Rubber and and Oil and General Finance." "The Edmund Eaton influence is again manifesting itself in the shape of further attempts to unload vendor shares in the Patent Block Tar, Motor Oil, and Asphalte Company, Limited. The address from which the literature is now being circulated is 6, Abchurch Lane, Cannon Street, E.C.—an office used by Mr. Edmund Eaton, late of 5, Dowgate Hill, and 99, Cannon Street, E.C., where he was notorious for the promotion of worthless gas and water companies. It is interesting to note that Mr. H. W. L. Way, J.P., appears as Chairman, and Captain John Maclean as Vice-Chairman, on these circulars. These gentlemen have been associated with the following unsatisfactory promotions: East Sussex Gaslight and Water Company, Limited; Laindon and District Gaslight and Coke and Water Company, Limited; Glynhir Collieries, Limited; Rawcliffe (Yorks) and District Gas and Coke Company, Limited; Robertsbridge, Salehurst, and Hurst Green Water Company, Limited; Ticehurst and District Water and Gas Company, Limited; Water and Gas Debenture Share and Investment Trust, Limited; and the Whitland and District Water and Gas Company, Limited. It may interest those who have not already heard of the Patent Block Tar, Motor Oil, and Asphalte Company, Limited, to know that this concern was registered early in 1907 as the Tar Patent Solidifying and Distilling Company, Limited; the title being subsequently changed to the Patent Block Tar Gaseous Fuel Company, Limited, and later on to the Patent Block Tar, Motor Oil, and Asphalte Company, Limited. No dividend has been paid to the shareholders, and only a little experimental work has been carried out by Mr. Wallace Heims, C.E., M.E. A report is enclosed with the particulars. Mr. Heims, it will be remembered, was interested in the Natural Gas Company—a bubble formed by Mr. Edmund Eaton to discover natural gas in Sussex.* The circumstance of the origin of the Patent Block Tar, Motor Oil, and Asphalte Company, Limited, and its association with Mr. Edmund Eaton are sufficient to warn all investors that the shares should be left severely alone."

* Reference may be made to a report in our "Legal Intelligence" today.—ED. J.G.L.

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Accessibility, Durability, Simple Automatic Control, Compactness, and Efficiency.

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The DAVIS GAS STOVE CO., Limited, Luton.

Claim for Compensation for an Injury.

At the Shoreditch County Court last Tuesday, before His Honour Judge Smyly, K.C., an arbitration under the Workmen's Compensation Act was down for hearing, in which Albert Bacon, a gas-fitter, asked for an award against the Gaslight and Coke Company. He stated in his claim that he was working at the Baptist Chapel, in Queen's Road, Dalston, on the 15th of August last, when he sustained an internal injury which had rendered him incapable of doing heavy work. He went on till the following Friday, and then saw the club doctor in connection with the Company, who directed him to go to the hospital. He was off work from the 18th of August to the 18th of September, when he was given a fortnight's work with the Company; but at the end of the time he was discharged, owing, as they alleged, to slackness. He ascertained, however, that this was not the case. He did not get any work till the 9th of November; and for these periods he asked for an award of 15s. a week, half wages. Mr. Dale, who appeared for the applicant, said he was only asking for an award of 1d. a week to be entered, to keep the matter alive, as his present berth might not be permanent. As to the weekly amount, he presumed this was only a formal matter, as the Company had not attended. His Honour thought it was a most extraordinary attitude for the Company to take up. They should either admit the claim or attend to dispute it. He made an order in the terms asked for.

Madrid Public Lighting.—According to the "Revista Minera," the Spanish municipal authorities some time ago appointed a Committee to investigate the question of street lighting in Madrid, with the view of effecting improvements on the expiration of the contract with the existing Company. A report has lately been published which gives the number of gas, electric, and petroleum lamps now employed for lighting the streets of Madrid. There are 14,096 gas-lamps, 852 petroleum lamps, and 196 electric arc lamps; and their annual cost is 2,505,701 pesetas. A peseta is nominally worth 9½d., but its actual value is 7½d.

Fatal Fall from a Gasholder Crown.—While working upon the crown of the gasholder now being erected by Messrs. Robert Dempster and Sons, of Elland, at the Hollinwood gas-works of the Oldham Corporation, a man named Robert Carmylie, a riveter, slipped and fell a distance of 40 feet into the water in the tank. He was brought out and removed to the Royal Infirmary, where he died later in the day. At the Coroner's inquest, a witness who was working with the deceased said he had remarked that the roof was rather slippery, and told him (witness) to be careful not to fall off. Immediately afterwards he disappeared from view. There was frost at the place where they were working. Dr. Hamilton, the House Surgeon at the Infirmary, described the injuries sustained by the deceased, and said the cause of death was shock and loss of blood. A verdict of "Accidental death" was returned.

Successful Gas Exhibition at Ormskirk.

Particulars have reached us of a very successful exhibition of gas appliances recently held under the auspices of the Ormskirk Gas Company, and under the supervision of Mr. William M. Carr, their Engineer and Manager. It was opened by the Chairman of the Company (Mr. F. W. M. Gardiner), who explained that the Directors, having decided to fit up prepayment meter installations free of cost, thought it advisable to introduce the new development in the business of the Company by means of an exhibition, and so place before the consumers the great advantages and economy of gas for lighting, cooking, and heating. Special facilities were to be given to consumers to obtain gas appliances of every description at the lowest prices and on the easiest terms. The stoves were supplied by Messrs. Fletcher, Russell, and Co., Limited, who also showed a good collection of labour-saving gas appliances. On one side of the hall the Gas Company had three handsomely fitted rooms, where they demonstrated the use of gas as an illuminant. Cookery lectures and demonstrations were given twice daily by Miss Tuxford, Principal of the South Manchester School of Cookery; and they were well attended. This lady showed that a complete dinner could be cooked with ¾d. worth of gas on a stove that could be hired for 1s. a quarter, fixed free. A feature of the exhibition was a fine display of high and low-pressure lighting by the Welsbach Company. The lamps on the latter system ranged from 300 to 1000 candle power; those working at high pressure, from 1000 to 4000 candles. "Pharos" lamps of 2000-candle power were in operation inside the hall, and two of 4000 candles outside. They created quite a sensation, as they gave a light greater than had ever been seen at Ormskirk from any source. The exhibition was in every way successful; orders being obtained by Messrs. Fletcher, Russell, and Co. during the run of it for more than 400 cookers and a like number of free installations.

Alnwick Water Supply.—A Local Government Board inquiry was held at Alnwick last Friday, by Mr. A. A. G. Malet, M.Inst.C.E., in respect of an application by the Alnwick Urban District Council for sanction to borrow £4000 for water-works for the town. Mr. Robert Middlemas, the Clerk to the Council, referred to the efforts that had been made to improve and augment the present supply, and said the Council had, during shortage seasons, been assisted by the Duke of Northumberland from springs in Alnwick Park, and now his Grace, in response to the Council's application, had generously agreed to grant a lease for 41 years, on favourable terms, of the water from those springs, from which the districts would derive an available and sufficient quantity of pure water. This, with the supply from the excellent sources which the Council proposed to retain, would fully meet the requirements of the district. The period for which the £4000 was required was 41 years; and this was a matter to which the Inspector promised to give particular attention.

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Johannesburg Lighting and Power Contract.

In the First Division of the Court of Session, last Wednesday, a settlement was announced of the action by the Municipal Council of Johannesburg against Messrs. D. Stewart and Co. (1902), Limited, William Beardmore, shipbuilder and steel manufacturer, and others, for payment of £115,134, the amount of a bond guaranteed by Mr. Beardmore and others for the performance of the contract, £145,000 claimed as money paid, and £200,000 as damages. It may be remembered that these sums were sued for on the ground that the above-named Company failed to carry out contracts entered into by them with the plaintiffs for the installation of gas-producing plant, gas-engines, and electrical plant for tramways, lighting, and power purposes. The case came before the Court in 1908, and was in the Inner House and in the House of Lords on appeals before it went to proof last year before Lord Ormidale, when the inquiry lasted for more than a month. Lord Ormidale decided against both sets of defendants for payment of £115,134; reserving to Mr. Beardmore the right of relief against the other defendants, and also against Messrs. D. Stewart and Co. for payment of £224,043. These defendants were also found liable in expenses. [See "JOURNAL," Vol. CXVI., p. 192.] The defendants appealed to the First Division; but the action has now been settled, the plaintiffs having accepted a payment of £100,000 and the right to the plant which had been installed.

Lower Prices at Sedgley.—The Sedgley Urban District Council have adopted a recommendation of the Gas Committee to make the following reductions in the price of gas, as from the 1st prox.: From 3s. 3d. to 3s. per 1000 cubic feet to consumers for lighting purposes by ordinary meter; from 3s. 11d. to 3s. 7d. for consumers by slot-meter; and from 2s. 9d. to 2s. 8d. in respect of the supply to Dudley Union Workhouse. Concessions are also made to users of gas for power purposes. Mr. Ivor Morgan (the Chairman of the Gas Committee) said the suggested reductions were in addition to the sum given in relief of the rates.

Smoke in Manchester.—Writing on this subject in a recent number of the "Manchester Daily Dispatch," Mr. E. D. Simon, the Hon. Secretary of the Smoke Abatement League of Great Britain, said: "Such is the volume of soot which is annually poured forth into the Manchester atmosphere, that it would form a column 15 feet square, and three times as high as the tower of the Town Hall. The extra cost of electricity and gas for lighting Manchester owing to the fog on Jan. 29 this year was over £1450. When it is remembered that fogs owe their dark and noxious character entirely to smoke, this figure is surely rather startling. The total damage done by smoke in Manchester is estimated at well over a million pounds sterling per annum. We believe the time is now ripe for the formation of a Manchester and District Branch of the Smoke Abatement League of Great Britain, to carry on a vigorous campaign. Though the Manchester Corporation employ five smoke inspectors for the purpose of regulating factory smoke, the surrounding authorities do little or nothing in this direction. We propose to employ a smoke inspector of our own to bring pressure to bear upon surrounding authorities to do their duty in this matter. We propose, also to do everything we can, by educational and other means, to tackle the domestic smoke problem, and to stimulate the use of smokeless fuels in place of smoky coal."

Monte Video Water-Works Company, Limited.—In moving the adoption of the report of this Company (noticed last week) at the ordinary general meeting on Wednesday, the Chairman (Mr. James Anderson) referred to the remarkable development which had taken place in the business in the last few years. At the close of 1907, the total number of services was 15,670; in 1908 it rose to 16,839; in 1909, to 18,841; in 1910, to 21,763; and in 1911, to 24,890. In five years the number of their customers had increased by 59 per cent., or an average of about 12 per cent. per annum; whereas last year the increase was 14 per cent., which he thought the shareholders would agree was a remarkable rate of progress for a long-established water company. The expansion of the business, besides benefiting the revenue account, had enabled them to make a reduction in their tariff for the supply of water. There was little doubt that the cheapening of the water supply had been one of the main factors which had led to the expansion of the business; and, quite beyond this, the Board had always felt that, as a Company holding a practical monopoly of the water supply of a great city, they were bound to consider the claims of the community as well as those of the shareholders. The Chairman then dealt in detail with the accounts, and read a letter from the Manager with reference to the satisfactory economic conditions of the country. After a short discussion, the report was unanimously adopted.

Barnard Castle Gas Company.—At the 78th annual general meeting of this Company, held last Thursday, under the presidency of Mr. W. J. Watson, the Vice-Chairman, the proprietors were informed that the sale of gas last year had been about the same as in 1910. The mains had been thoroughly overhauled and tested, and partially relaid; and this accounted for part of the increased expenditure on mains and services. A decreased leakage was expected to result. Pursuant to the scheme approved by the special general meeting in July last, a high-pressure steel main had been laid to the villages of Lartington and Cotherstone, with compressing plant at the works. A fair number of the householders had already become consumers, and expressed themselves as very well satisfied with the service. Referring to the coal miners' strike, the Chairman said the Manager, at its commencement, estimated that he had sufficient coal in stock to last, with economy, for about four weeks. Fortunately the Directors had been able to arrange locally for a further delivery, which, if continued, would enable the Company to avoid a stoppage of the supply of gas; but they were asking consumers to exercise economy. The accounts showed a balance of £1149 available for distribution; and the meeting adopted the Directors' recommendation to declare dividends at the rate of 6 per cent. per annum on the original stock and £4 5s. 8d. on the new stock, at which former rate the interim dividend was paid in September last.

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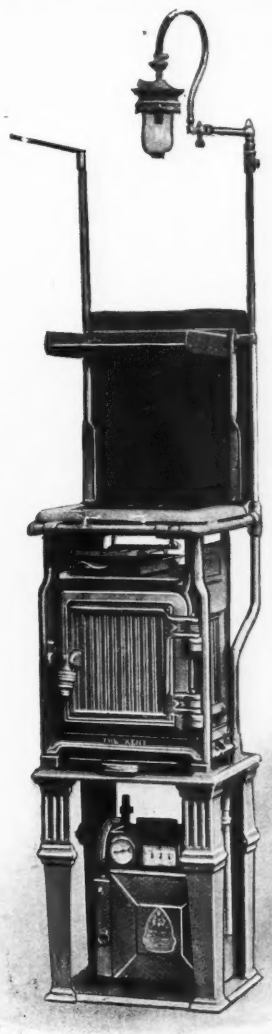

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SHOW-ROOMS AND BRANCHES: 25, Princes St., Oxford Circus, W.; 136, Renfield St., GLASGOW; 56, Broad St., BIRMINGHAM; 83, Old Market St., BRISTOL; 13, Whitworth St. West, MANCHESTER; 8, Exchange Place, Donegall St., BELFAST; 333, Queen St., MELBOURNE; and 12, Cunningham Lane, Pitt St., SYDNEY, N.S.W.

Municipal Trading in Gas Appliances at West Bromwich.

The tradesmen of West Bromwich have for some time been complaining of the competition which they have to face from the Municipality, and the gas-fitters, electricians, and plumbers have now enlisted the co-operation of the Tradesmen's Association, who have sent a strong protest to the Corporation against municipal enterprise, which they consider both unfair and unreasonable. In the course of an interview with the representative of a local paper, the Gas Engineer (Mr. Harold E. Copp) characterized the complaints as all nonsense. He said the Corporation did not sell anything at competitive prices, and always made it a rule to charge a little higher rather than a little lower than their own tradespeople. All that the Gas Department's show-room was for was to show gas consumers what they ought to have. Mr. Copp pointed out that the shop, which had been in existence eighteen months, was not opened to make profit; and if the local tradesmen would keep the right stuff, and sell it, they would have no cause to complain. He thought if they had any complaints to make against municipal trading at the shop they should formulate them in detail, and send them to the Gas Committee, and they would, he was quite sure, receive every consideration. He explained that in every town now corporations or private gas companies had their show-rooms—in fact, he believed they were absolutely essential for up-to-date gas undertakings; and it was only fair to the consumers as well that they should have as great a choice as possible. Mr. Copp further stated that he had introduced at the municipal gas-shop no end of special lines which the local tradesmen were also now selling, and he considered that when he got novelties he could judge better than they could as to whether or not they were good.

Little Hulton in Darkness.—Readers will no doubt remember that the greater portion of the township of Little Hulton, near Bolton, is lighted by gas obtained from the coke-ovens at the Earl of Ellesmere's Brackley Colliery at Middle Hulton. Owing, however, to the difficulty experienced in obtaining the necessary acids for running the ovens, the usual supply of gas has failed. Great inconvenience, as a result, is being experienced by traders; and services in local places of worship were abandoned last Sunday night.

Antwerp Water-Works Company, Limited.—Including £6594 brought forward, the accounts for the past year show a profit of £76,877, out of which debenture interest has been paid and £1593 transferred to the general reserve fund (making it £30,000, which is the limit authorized), while £7024 has been added to the sinking fund for the redemption of the debentures, and £6250 to the sinking fund for the amortization of the share capital. The Directors recommend a further dividend of 6½ per cent., making 12 per cent. for the year, the transfer of £10,255 to the special reserve fund, making it £20,000, and leaving £4551 to be carried forward.

Windsor Gas Company.—At the recent half-yearly general meeting of this Company, the Directors reported that the quantity of gas made in the six months ended Dec. 31 last was 48,361,800 cubic feet of which 40,467,900 cubic feet had been sold and 44,235,200 cubic feet accounted for. There was a falling-off in the revenue as compared with the corresponding period of 1910; but this was accounted for by the reduction in the price of gas from 3s. 6d. to 3s. 4d. which came into operation last July, and by the exceptionally mild weather in November and December. The Chairman (Dr. W. H. Holderness), in moving the adoption of the report, mentioned that the Company had sold no less than 40,000 gallons of tar in the half year, owing to its increased use for spraying the surface of roads. The lighting of the town was satisfactory, the Company's employees were contented, and so were the Directors; and, so far as the works and the men were concerned, they had the best. He considered the Company were in a very sound position. Dividends were declared at the rates of 10 and 7 per cent. per annum on the original and new shares, and of 5 per cent. on the preference shares. A vote of thanks was accorded to the Engineer and Manager (Mr. H. Buckley), the Secretary (Mr. W. E. Free), and their staffs, for the way in which they carried on their work. Gratification was expressed at the happy relations existing between the Company and their workmen, a good deal of which was attributed to the fact that they worked in harmony with Mr. Buckley. Both of the gentlemen named acknowledged the vote; the former remarking that he could not wish for a better set of men than those he had under him.

The capillary raising of water in soils has lately been discussed by Mr. Oscar E. Meinzer in a paper on water supply issued by the United States Geological Survey. According to an abstract in "Engineering Record," he quotes Professor E. W. Hilgard as saying that the maximum height of capillary rise thus far observed is 10·17 feet. Mr. C. H. Lee concludes that in the area he investigated in Owens Valley (Cal.) no appreciable evaporation occurs from soil where the depth to water exceeds 8 or 9 feet. For most soils, capillarity is probably not effective except where the water stands considerably nearer the surface than 10 feet. The rate at which water is raised by capillary action depends upon the character of the soil and the height the water is lifted. It is more rapid in sandy than in clay soil, and where the water is near the surface than where it is several feet below it. In an experiment made in 1905, Professor C. S. Slichter found that the evaporation during the period from Aug. 6 to Sept. 3 was as follows: From open water, 10·90 inches; from cultivated soil with 1 foot to water, 4·88 inches; from uncultivated soil with 1 foot to water, 5·83 inches; from soil with 2 feet to water, 2·23 inches; from soil with 3 feet to water, 0·80 inch. The soil was sandy loam. Mr. Lee came to the conclusion from his experiments, that where the water level is not more than 3 feet nor less than 1 foot below the surface, a depth of evaporation can be expected of about 80 per cent. of that from the surface of a body of water which is exposed to the air.

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LOW-PRESSURE AND HIGH-PRESSURE GAS.

FLETCHER, RUSSELL, & CO., LIMITED,

WARRINGTON, MANCHESTER, BRUSSELS, & LONDON.

Proposed New Gas Show-Room at Carlisle.—At a special meeting of the Carlisle Town Council last Friday, a proposal by the Gas Committee to take on lease for 21 years, at an annual rent of £250, with the option of purchase within five years at an agreed price, certain premises suitable for providing more adequate accommodation for stores, show-rooms, fitting and repairing shops, &c., gave rise to a long discussion. A counter-proposal was brought forward to refer the matter back to the Committee, with a request that they should continue the use of the present show-rooms, and submit plans and estimates for new stores and other offices within the gas-works; and it was carried by 19 votes to 10.

Bexhill Water and Gas Company.—At the ordinary general meeting of this Company next Thursday, the Directors will submit the accounts for the half year ended the 31st of December last, which show a balance of £5526 available for distribution. They recommend a dividend at the rate of 6 per cent. per annum on the £34,000 of capital authorized by the Acts of 1885 and 1892, and at the rate of £4 4s. per cent. per annum on the £114,570 authorized by the Acts of 1896 and 1904 and the Provisional Order of 1901, less income-tax. This, with provision for income-tax, will absorb £342, and leave £2100 to be carried forward. The Directors say there is an indication that Bexhill is on the eve of considerable development and extension. The water-mains have already been laid in many of the new roads; and the gas-mains will be extended as circumstances require.

The Bloxham and District Water Company, Limited—with offices at No. 50, Cannon Street, E.C.—was registered on the 15th inst., with a capital of £3000 in £1 shares.

An unusual case of assault has just been disposed of by the Portsmouth magistrates, resulting in a fine of 40s. upon a stove-fitter, who had been discharged by the Portsea Island Gas Company. The defendant had entered the Superintendent's office, and, in a rage, had blackened both eyes of the Superintendent, who, by the rules of the Company, was unable to retaliate.

Damage estimated at between £500 and £600 was caused at a Newport (Mon) drapery and outfitting establishment by a fire which was thought to have originated in a small gas explosion.

The "Standard" centrifugal washer in operation at the Crindau works of the Newport (Mon.) Gas Company, and capable of dealing with 4 million cubic feet of gas per day, it is reported, is found to lighten the purifying costs very considerably. According to the testimony of the Engineer and Manager (Mr. Thomas Canning, Assoc. M.Inst.C.E.), the machine works with great smoothness and regularity and is regarded as a valuable accessory to the purifying plant.

A dinner of the employees of Messrs. J. & W. B. Smith took place on Saturday at the Great Northern Station Hotel, King's Cross, to commemorate the fiftieth year of service of Mr. James Kerr, the Manager of the brilliant cutting department. A party of about eighty sat down; Mr. J. G. Watkinson (the Principal of the firm) occupying the chair, and Mr. F. Watkinson (the Manager) the vice-chair. In the course of the proceedings, Mr. Kerr was presented with an illuminated address and several other handsome gifts. It may be mentioned that Mr. Kerr started with the firm in Edinburgh, and afterwards went with them to Leith—later on migrating with them to London.

The Directors of the New Inverted Incandescent Gas-Lamp Company, Limited, report that the net trading profit for the past year, after allowing for depreciation and all trade charges, is £11,667. The balance of profit, as shown in the profit and loss account, amounts to £10,205, which, added to £1379 brought forward, gives a total available profit of £11,584. Out of this, £923 has been written off goodwill and £1537 off the patent account—bringing the total amount written off the latter account up to £20,037. From the balance, the Directors recommend the addition of £1000 to the reserve, and the payment of a dividend at the rate of 6¼ per cent., free of income-tax. This will absorb £6765, and leave £1357 to be carried forward. On July 1 last, £1000 was paid off the debentures, leaving £13,000 outstanding on Dec. 31. On Jan. 1 last, this was reduced to £12,000 by another £1000 being paid off.

GAS COMPANIES' STOCK AND SHARE LIST.

The Stock Exchange last week had much to cause it a considerable degree of anxiety; and it would not have been altogether surprising if markets had been seriously depressed. The aspect of foreign affairs and international relations with all their sinister possibilities, the bewildering uncertainty regarding the upshot of the Minimum Wage Bill, and the tightening of the Money Market, were weighty factors. But markets kept their heads and preserved an attitude of calm, which imparted an agreeable assurance of a strong intrinsic position. The opening day was far from encouraging; being very heavy and depressed. Government issues were weak, and Consols fell ¼. Railways naturally gave way; but, aided by a slight rally, they closed at no heavy loss. But Tuesday brought a better tone, with business brighter and more active. Consols picked up their loss, Rails were strong and advancing, and Americans were firmer. Wednesday was rather less confident, but with some bright spots. Gilt-edged were scarcely so strong, though Consols did not move, and Rails were a little shaky; but Americans went well. Thursday was quiet and cautious, awaiting developments. Consols were unchanged; but Rails were a shade easier. Friday opened with a much more cheerful tendency, which lasted most of the day. Consols advanced ¼; and rails were quite courageous. But later there was a reaction with the usual Friday selling; and the best prices were not maintained till the end. Saturday, however, was composed and fairly cheerful. Consols were done several times at 78, and closed at 77 3/4-78—a rise of ¼ in the week. Rails were firmer, in the hope that a settlement of some sort could not be far off. The Money Market opened very firm, and rates were stiff; but the tension gradually relaxed later on. Business in the Gas Market was again below the average, and it was to a most unusual extent restricted to a very small number of undertakings; there being not much disposition to either buy or sell. As might be expected from this, movements in quotation have been few and far between, and of very inconsiderable magnitude. In Gaslight and Coke issues, the ordinary was only moderately active, and was a shade easier; transactions ranging from 103 to 104¼—a fall of ¼. In the secured issues, the maximum changed hands at 84 and 84¼, the preference at 103, and the debenture at 80. South Metropolitan was inactive and firm, with prices ranging from 115 to 116½—a rise of 1. In Commercials, there were a couple of bargains in the 4 per cent., at 108½ and 109½. Among the Suburban and Provincial group, Bournemouth "B" was done at 16¼, Hastings and St. Leonards 3½ per cent. at 94 special, and—on the local Exchange—Liverpool "B" at 159¾. In the Continental companies, Imperial was weaker, changing hands at 190½ to 188 (a fall of 1), Union was done at 83½, ditto preference at 133⅞ and 134¼, and European at 20 to 20½. Among the undertakings of the remoter world, Bombay realized 6⅜, Buenos Ayres debenture 95¼, Monte Video 12, Primitiva from 7 9/16 to 7⅜, ditto preference from 5⅜ to 5 15/32, and River Plate debenture 95½.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 12	5	Alliance & Dublin Ord.	79—82	..	6 1 11
374,000	Stk.	Jan. 12	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
250,000	5	Sept. 28	7½†	Bombay, Ltd.	6⅝—6⅞	..	5 13 2
50,000	10	Feb. 29	15	Bourne- mouth Gas & Water Pref. 6 p.c.	28½—29½	..	5 1 8
					16—16½	..	4 4 10
75,000	10	,,	6		14—14½	..	4 2 9
380,000	Stk.	,,	13	Brentford Consolidated	258—263	..	4 18 10
330,000	,,	,,	10	Do. New	195—200	..	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
206,250	,,	Dec. 14	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
219,055	Stk.	Feb. 29	11	Brighton & Hove Orig.	215—220	..	5 0 0
244,200	,,	,,	8	Do. A Ord. Stk.	156—159	..	5 0 8
490,000	20	Sept. 28	12½	British	45½—46½	..	5 7 6
120,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. Stk.	93—95	..	4 4 3
109,000	,,	Feb. 15	6	Bromley, A 5 p.c.	126—131	..	4 11 7
165,700	,,	,,	4½	Do. B 3½ p.c.	98—101	..	4 9 1
82,278	,,	,,	5½	Do. C 5 p.c.	117—120	..	4 11 8
55,000	,,	Dec. 29	3½	Do. 3½ p.c. Deb.	80—82	..	4 5 4
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	95—97	..	4 2 6
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4—5	..	—
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	76—80	..	5 12 6
157,150	Stk.	Feb. 15	5	Chester 5 p.c. Ord.	110—112	..	4 9 3
1,513,280	Stk.	Feb. 29	5/9/4	Commercial 4 p.c. Stk.	107½—109½	..	5 0 6
560,000	,,	,,	5½	Do. 3½ p.c. do.	103—105	..	5 1 6
475,000	,,	Dec. 14	3	Do. 3 p.c. Deb. Stk.	75—77	..	3 17 11
800,000	Stk.	,,	4	Continental Union, Ltd.	82—85	..	4 14 2
200,000	,,	,,	7	Do. 7 p.c. Pref.	133—135	..	5 3 8
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
840,150	10	Jan. 31	10	European, Ltd.	20—21	..	4 15 3
16,160,600	Stk.	Feb. 15	4/14/8	Gas-light and Coke 4 p.c. Ord.	103—104	−¼	4 11 0
2,600,000	,,	,,	3½		83½—85½	..	4 1 10
4,062,235	,,	,,	4		102—104	..	3 16 11
4,531,705	,,	Dec. 14	3		79—81	..	3 14 1
258,740	Stk.	Mar. 14	5	Hastings & St. L. 3½ p.c.	93—95*	..	5 5 3
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 12	11	Hongkong & China, Ltd.	17—17½	..	6 5 9
131,000	Stk.	Mar. 14	7½	Ilford A and C	152—154*	..	4 17 5
65,780	,,	,,	6	Do. B	123—125*	..	4 16 0
65,500	,,	Dec. 29	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
4,940,000	Stk.	Nov. 10	9	Imperial Continental	188—191	−1	4 14 3
1,235,000	Stk.	Feb. 15	3½	Do. 3½ p.c. Deb. Red.	88—90	..	3 17 9
200,242	Stk.	Mar. 14	6	Lea Bridge Ord. 5 p.c.	125—129*	..	4 13 0
561,000	Stk.	Feb. 29	10	Liverpool United A.	220—222	+1	4 10 1
718,100	,,	,,	7	Do. B.	159½—161½	..	4 6 8
306,083	,,	Dec. 29	4	Do. Deb. Stk.	100—102	..	3 18 5
75,000	5	Dec. 14	6	Malta & Mediterranean	4⅞—5	..	6 0 0
560,000	100	Oct. 2	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 10	3½	Monte Video, Ltd.	12—12½	..	5 12 0
1,775,892	Stk.	Feb. 15	4½	Newc'tle&G'tesh'd Con.	99—101	..	4 6 8
529,705	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	86—88	..	3 19 7
55,940	10	Feb. 29	7/7/0	North Middlesex 7 p.c.	14—15	..	4 18 0
300,000	Stk.	Dec. 14	8	Oriental, Ltd.	137—139	..	5 15 1
60,000	5	Mar. 14	8	Ottoman, Ltd.	7—7⅛*	..	5 6 8
31,800	53	Feb. 29	13	Portsea Island A	137—140	..	4 18 4
60,000	50	,,	13	Do. B	130—133	..	4 17 9
100,000	50	,,	12	Do. C	127—130	..	4 12 4
398,490	5	Oct. 12	8	Primitiva Ord.	7⅛—7⅜	..	5 3 3
796,980	5	Dec. 29	5	Do. 5 p.c. Pref.	5⅛—5⅜	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	Dec. 29	4	River Plate 4 p.c. Deb.	95—97	..	4 2 6
250,000	5	Sept. 28	12	San Paulo, Ltd.	11¼—11⅞	+¼	5 2 2
115,000	10	,,	6	Do. 6 p.c. Pref.	11½—12	..	5 0 0
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	50—51	..	4 18 0
135,000	Stk.	Mar. 14	10	Sheffield A	235—237*	..	4 4 5
209,984	,,	,,	10	Do. B	234—236*	..	4 4 9
523,500	,,	,,	10	Do. C	234—235*	..	4 5 1
90,000	10	Sept. 28	6	South African	8—9	..	6 13 4
6,429,895	Stk.	Feb. 15	5/9/4	South Met., 4 p.c. Ord.	115—117	+1	4 13 5
1,895,445	,,	Jan. 12	3	Do. 3 p.c. Deb.	78—80	..	3 15 0
209,820	Stk.	Feb. 29	8½	South Shields Con. Stk.	156—158	..	5 7 7
605,000	Stk.	Feb. 15	5/16/8	S'th Suburb'n Ord. 5 p.c.	121—123	..	4 14 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	,,	Jan. 12	5	Do. 5 p.c. Deb. Stk.	119—121	..	4 2 8
502,310	Stk.	Nov. 10	5	Southampton Ord.	107—109	..	4 11 9
120,000	Stk.	Feb. 15	7½	Tottenham A 5 p.c. and B 3½ p.c.	144—147	..	4 17 0
483,940	,,	,,	5⅝		114—116	..	4 17 0
149,470	,,	Dec. 29	4	Edmonton 4 p.c. Deb.	95—97	..	4 2 6
182,380	10	,,	5	Tuscan, Ltd.	8⅜—8⅞	..	5 12 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
236,476	Stk.	Feb. 29	5	Tynemouth, 5 p.c. max.	112—114	..	4 7 9
255,636	Stk.	,,	6⅞	Wands-worth B 3½ p.c. 3 p.c. Deb. Stk.	141—144	..	4 15 6
85,766	,,	Dec. 29	3		71½—73½	..	4 1 8

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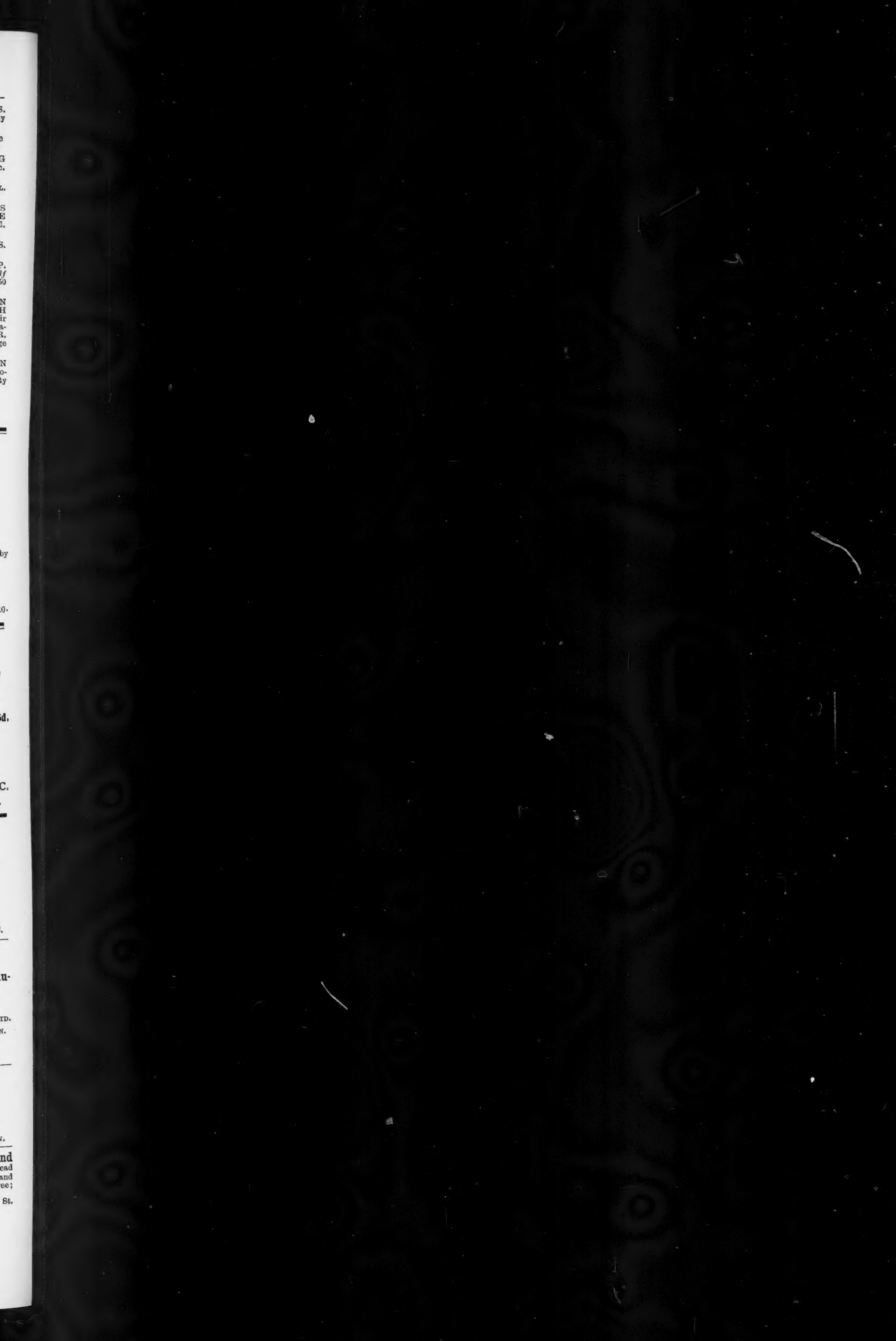
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